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The Public Lighting Tables of the American Meter Company will be found in the page advertisement of that Company.

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[OFFICIAL NOTICE.]

Tenth Annual Meeting of the Pacific Coast Gas Association.

PACIFIC COAST GAS ASSOCIATION,
OFFICE OF THE SECRETARY,
HAYWARD BUILDING, SAN FRANCISCO, CAL.

The Tenth Annual Meeting of the Pacific Coast Gas Association will be held in San Francisco, Cal., Tuesday, Wednesday and Thursday, July 15th, 16th and 17th, 1902. The meeting will be called to order in the Lecture Hall of the Pacific Gas Improvement Company, in their new building, No. 455 Sutter street. A reception room, reading room, and other conveniences will be provided for the use of members during the session. All books purchased during the past year by the Library Committee, and which form the nucleus of what bids fair to become a valuable library, will be placed at the disposal of the members for their use and inspection.

The following papers will be read:

President's Address, by Mr. C. E. Burrows, WallaWalla, Washington.

"Fuel Conditions in California," by Mr. John L. Howard, San Francisco, Cal.

"Gas Advertising," by Mr. R. P. Valentine, Sacramento, Cal.

"Municipal Ownership," by Mr. Frank J. Symmes, San Francisco, Cal.

"Differential Gas Rates," by Mr. M. C. Osborn, San Rafael, Cal.

"An Experiment on the Principles of Purification," by Mr. E. C. Jones, San Fransisco, Cal.

"Electrically Operated Appliances in Gas and Electric Works," by Mr. Geo. C. Holberton, Oakland, Cal.

"The Recognition of the Engineer, with Especial Reference to Gas Engineering," by Mr. L. P. Lowe, San Francisco, Cal.

A lecture will also be given by Mr. P. W. Tompkins, Analytical Chemist, of San Francisco, Cal., upon "The Methods of Determining Water and Sediment in Crude California Petroleum."

Wednesday evening, July 16th, at 7.30 o'clock, the usual annual banquet will be given, at which members only will be in attendance.

Thursday, July 17th, an outing will be arranged for the benefit of members and their families. A bay trip, to Vallejo and the United States Navy Yard at Mare Island, is contemplated, and it is hoped that satisfactory arrangements can be made whereby the privileges of the Yard will be extended to the Association. Few travelers to San Francisco are given the opportunity to visit the upper reaches of San Francisco and San Pablo bays, whose quiet waters are broken only by the picturesque Italian fishing smack, an occasional river steamer, or the characteristic homely, square-nosed, scow schooner, which, heavily freighted, lazily drifts down the tide to the markets of the world, or plunges frantically in the sea when the cool, invigorating ocean breezes blow.

Monday evening, July 14th, there will be an informal meeting at headquarters.

Contributions to the "Wrinkle Department" should be sent to Editor Geo. S. Colquhoun, Fresno, Cal., without delay.

Those who have had experiences in the past year which might prove of interest to members, are requested to send them to Mr. R. P. Valentine, of Sacramento, Cal., Editor of the "Experience Department."

The Question Box is a valuable feature of the meeting. It is desirable that all questions be forwarded to the Secretary as far in advance as possible in order to secure proper attention thereto.

J. B. GRIMWOOD, Secretary.

LIBRARY OF CONGRESS, JUL 14 1902

[Official Notice.]

Wrinkle Department, Pacific Coast Gas Association.

Office of Editor, Wrinkle Department,
Pacific Coast Gas Association,
1050 J Street, Fresno, Cal., May 14, 1902.

To the Members of the Pacific Coast Gas Association: As the Tenth Annual Meeting of the Pacific Coast Gas Association is drawing near, it behooves me, as the Editor of your Wrinkle Department, to remind you that it is time you were sending in your contributions to this department.

Wrinkles mean any small or large device, original in idea if possible, or anything that is not generally known to the gas fraternity, and that will in any way alleviate the trials and troubles of the gas man and promote his welfare and happiness, will be acceptable as a Wrinkle. If you will send in a sketch, photo or drawing, with explanation, it will be fully appreciated at our meeting this summer, as it depends entirely on the contributions, and following discussion of the members, to make these meetings successful.

Now, please, do not be backward, but send in all the Wrinkles you can gather up at once, and before you forget it. You may sign your name or not; just as you like. You surely have around your works, office, or main and service system a lot of original ideas that would be a benefit to some other member who is working under the same conditions.

Kindly make your contributions to this department at once, so as to enable me to get them in order before the meeting. Expecting an early reply, I am, Yours truly, George S. Colquhoun.

BRIEFLY TOLD.

Books Received.—"Field's Analysis."—Through the courtesy of the compiler, Mr. John W. Field, we have received from his publishers, Messrs. Eden Fisher & Co., of London, England, a copy of "Field's Analysis," which has to do with "the accounts of the principal gas undertakings in England, Scotland and Ireland for the year 1901." The present volume numbers the 33d year of its publication, and it is our pleasant province to say of the book that as it grows older it grows more valuable, for within its covers is concisely printed a revealment of the tremendous growth of the gas industry in the home realms of Great Britain, as such growth is developed year to year. Orders for it may be sent to us.

Hornby's "Gas Engineer's Laboratory Handbook," for a copy of the 1902 edition of which we are indebted to Messrs. Spon & Chamberlain, of New York city, needs little recommendation at our hands. The first edition of the book was sufficient to commend it to all gas engineers who had and have to do with the finer details of gas manufacture. In the preface to the current or revised edition the publishers note that the original section on "Gas Analysis" has been revised and enlarged. The new chapters contain lucid accounts of the description and use of the Orsat-Muencke apparatus, the method of determining the calorific power of gas, the estimation of cyanogen in gas and the valuation of oils for gas making purposes. Just now the latter chapter has much of interest for the American gas maker. The index to the book is much better than the one that obtained in the original edition.

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Notes.—In our item columns for last week it was said that Mr. A. B. Saye, formerly Manager of the Athens (Ga.) Gas Company, had been appointed Manager and Superintendent of the Meridian (Miss.) Gas Company, vice Mr. W. H. Frapwell, resigned. Mr. Saye was appointed assistant to Mr. J. M. McKee, who still continues as Superintendent of the Company. Mr. Saye's duties will in the main be related to the outdoor work of the Meridian Company.——An original advertising scheme was successfully tried by the Gas Appliance Company, in connection with calling attention to the use of gas for fuel in Baltimore, Md. On July 4th several balloons were sent up from the Appliance Company's offices, the balloons containing tags carrying the inscription, "The bearer is entitled to a gas range free," or "If the bearer presents this to the Gas Appliance Company he will receive $1 in cash." Several of the tags were "cashed in."

The Valuation of Gas Oils.[1]

By Mr. J. P. Leather, of Burnley.

The "Transactions" of the Gas Institute are not without some information as to the quantity and quality of gas to be obtained from oil by various processes. There is, however, probably room for considerable increase in the knowledge we possess of the properties required of a gas oil, and how these are to be determined. When, a few years ago, I contemplated the erection of a carburetted water gas plant, I understood that there was practically no great difference between one petroleum oil and another—provided, of course, that the oil used was that boiling between certain customary limits.

After the erection of our plant, we obtained very good results from the Russian "solar" distillate, which we purchased for our first season's working.

The following season we bought a cheaper oil, which was raised in Borneo. The poor results led to an examination, which soon disclosed important differences in the chemical composition of the oil, as compared with that previously used. My colleague, Mr. Raymond Ross, F.I.C., and I determined to enter on as complete an investigation as possible into the constitution of the various gas oils on the market.

Mr. Ross went into the matter with such enthusiasm that we soon had a large volume of facts, which are duly set forth in a joint paper read before the Society of Chemical Industry in Manchester last month.

Instead of giving a consecutive history of the various steps through which we were led in our experiments, I propose to briefly set forth the constitution of the different classes of hydrocarbons found in petroleum and in this way lead up to a consideration of the reason for variations in the gas producing qualities of these oils. If we know the reason for such variations, we can better understand what tests to apply as a means of commercial valuation.

Hydrocarbons may be divided into two classes—the open chain and the closed chain compounds. The open chain compounds are subject to decomposition or cracking with a moderately elevated temperature. The more carbon atoms contained in the molecule, the lower the temperature at which cracking commences. Indeed, with the higher compounds, cracking begins at temperatures below those at which they boil under the ordinary atmospheric pressure. It is, therefore, only possible to completely distil these without change by the use of reduced pressure. This cracking at first means simply the division of the molecules into similar molecules containing a smaller number of carbon atoms; the new bodies being also liquids at the ordinary temperature, so that practically no gas is made. The compounds formed are open chain compounds. Olefines produce olefines; paraffines produce paraffines and olefines. As the temperature is raised, the decomposition becomes more thorough, and hydrogen and marsh gas are split off together with olefines. Marsh gas is undecomposed, even at exceedingly high temperatures. At a high temperature, however, there is a tendency to produce acetylenes; and an opposite action commences. The acetylene polymerizes to benzene; and at still higher temperatures further condensation takes place—other closed chain compounds, such as naphthaline, being formed.

The fact that these closed chain compounds are formed at high temperatures necessarily means that these compounds are exceedingly stable at high temperatures. If, therefore, our oil contains closed chain compounds to begin with, we should expect that they would not help to produce any quantity of gas. These compounds may indeed be cracked at a very high temperature; but the cracking results largely in coke and pitch, with but little gas, and that of practically no luminosity. This has already been pointed out by several workers—notably by Mr. W. Irwin, in communications to the Society of Chemical Industry.

In speaking of closed chain compounds, it must be remembered that these are of two kinds—those which are homologous with benzene, and are unsaturated, and those which contain a larger quantity of hydrogen, and are known as naphthenes or cycloparaffins These latter have not been so thoroughly investigated by chemists, but are generally found in greater or less quantity in all petroleums, and constitute the determining factor in producing the inferior results obtained when cracking Borneo oil. Though the naphthenes may yield rather more gas than the benzene homologues, the gas contains practically no illuminants.

1. A paper read before the Incorporated Gas Institute, at its 39th General Meeting, June 10-12, Southampton, England.

It is also evident that, if we endeavor to crack a mixture of paraffines, olefines, and naphthenes, on the one hand a temperature producing good results with the paraffines and olefines will be insufficient to decompose the naphthenes; while, on the other hand, a temperature sufficiently elevated to crack the naphthenes will overcrack, and entirely spoil the gas obtained from the paraffines and olefines.

It will therefore be seen that the value of a gas oil is practically proportioned to the percentage of paraffines and olefines present; the benzenes and naphthenes being of no value except as tar. The analysis of an oil to determine what percentage of these compounds it contains is not very simple. The aromatic compounds and olefines can be determined by sulphonation, and by the action of bromine and Nordhausen sulphuric acid. The relative quantities of the paraffines and naphthenes may be approximately estimated by taking portions separated by fractional distillation and determining the specific gravity and refractive index.

For compounds boiling at the same temperature, both the specific gravity and the refractive index are much higher for the naphthenes than for the corresponding olefines or paraffines. The specific refraction $\left(\frac{u-1}{-\text{d.}}\right)$ is, however, higher for the olefines than for the paraffines; and in this respect the naphthenes do not differ much from the paraffines—at least, for the single ring compounds.

Having thus briefly sketched the lines on which an oil may be examined, I will give a concrete instance of the method of deduction to be employed. Five different samples of oil were taken. They were separated by distillation into a number of fractions, each of which was separately examined. I do not propose to recapitulate the whole of the figures obtained, but simply to indicate the general character of each oil.

The following table will show how they differed one from another:

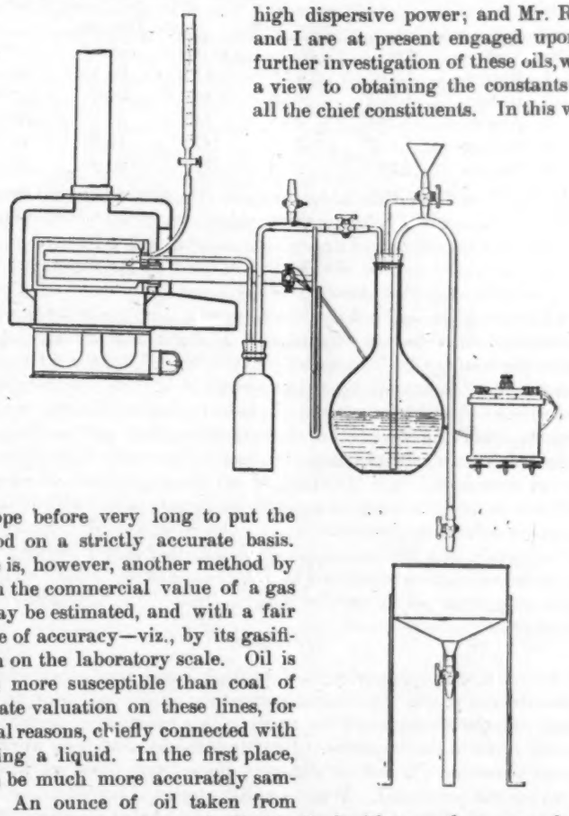
No.	Source of Oil.	Specific Gravity.	Refractive Index at 25° C.	Specific Refraction.	Boiling Point.
1	Russia.....	.825	1.4521	.548	115—300° C.
2	Russia.....	.872	1.4794	.549	200—430° C.
3	America.....	.851	1.4723	.555	150—420° C.
4	Borneo.....	.901	1.5067	.562	170—330° C.
5	Texas	.883	1.4806	.544	200—380° C.

It will be seen that No. 1 oil has a much lower gravity than No. 4, although its boiling point is nearly as high. Nos. 2 and 3 actually boil at a much higher temperature, and yet do not reach the gravity of No. 4; nor is their refractive index so high. A specific gravity of .901, coupled with a boiling point below 330° C., is a sure sign of the presence of closed chain compounds. As this oil, on being shaken with concentrated sulphuric acid, is found to have no appreciable quantity of aromatic compounds, it evidently contains a large proportion of naphthenes.

On comparing the specific gravity and refractive index of No. 5 with the figures for Nos. 2 and 3, similar differences are observed, though not to the same extent as in the case of No. 4. It was also found, on shaking with concentrated sulphuric acid, that about 5 per cent. of the oil dissolved in the acid, showing the presence of that amount of the homologues of benzene. These have a greater effect on the gravity than the naphthenes; but in this small quantity they would not suffice to raise the gravity so high as that found. This oil, therefore, also contains a considerable quantity of naphthenes. When the relation between the refractive index and the gravity—*i. e.*, the specific refraction—is examined, further peculiarities are noticed. No. 5 has the lowest specific refraction; Nos. 1 and 2 give slightly higher figures; while those for Nos. 3 and 4 are much higher. This points to the small percentage of olefines in No. 5, as also in Nos. 1 and 2, compared with No. 3, and to the large percentage in No. 4. This deduction is entirely confirmed by other experiments, in which the amount of olefines was determined in the different fractions by means of bromine, and also by the action of Nordhausen sulphuric acid.

When this method of deduction is applied to fractions of the oil boiling within a small range of temperature, it is possible to calculate approximately the relative proportions of the different constituents. To do so with accuracy, however, it is necessary to know the specific gravity and refractive index of a number of compounds which have not yet been prepared in the pure form. By determining the vapor density of a fraction, and thus deducing the number of carbon atoms in the molecules, it is possible to calculate the specific refraction of the component bodies by Brühl's law.

This law does not, however, give accurate results for hydrocarbons of high dispersive power; and Mr. Ross and I are at present engaged upon a further investigation of these oils, with a view to obtaining the constants for all the chief constituents. In this way we hope before very long to put the method on a strictly accurate basis. There is, however, another method by which the commercial value of a gas oil may be estimated, and with a fair degree of accuracy—viz., by its gasification on the laboratory scale. Oil is much more susceptible than coal of accurate valuation on these lines, for several reasons, chiefly connected with its being a liquid. In the first place, it can be much more accurately sampled. An ounce of oil taken from a cargo of 1,000 tons is practically identical with any other ounce from the same cargo. Secondly, being a liquid, it can be handled more readily, and can be passed into a retort without loss at any required rate. Thirdly, as the retort has not to be opened for the reception of the charge, the temperature can be exactly regulated.



The apparatus Mr. Ross and I have designed for this purpose is shown on the diagram. An iron retort is heated in a gas muffle furnace to a temperature which is measured accurately by an electrical pyrometer. The oil is passed slowly in by a tube projecting a short distance into the retort; while the gas produced leaves by a tube reaching nearly to the back. The gas is collected, measured, analyzed and its specific gravity determined.

The whole working of the apparatus, together with the following table of the gasification of oils, will be found in the paper already referred to, in the *Journal of the Society of Chemical Industry.*

	Russian Solar Oil.	Borneo Solar Oil.	American Solar Oil.	Texas Solar Oil.	Russian Refined Oil.
Quantity of gas per c.c. of oil, corrected to N.T.P..	465.7 c.c.	301 c.c.	442.6 c.c	397.4 c.c.	429 c.c.
Density (air = 1)	0.833	0.765	0.885	0.737	0.775
Weight of gas made per c.c. of oil....	0.502	0.298	0.506	0.388	0.430
Tar by difference, per cent.....	42 5	67.0	40.5	57.0	47.9
Analysis of Gas.	**Per Cent.**	**Per Cent.**	**Per Cent.**	**Per Cent.**	**Per Cent.**
Hydrocarbon vapors.	4.0	4.0	3.2	3.4	3.8
Heavy hydrocarbons	30.2	22.8	33.0	26.8	28.0
Methane.....	54.2	60.0	52.5	56 2	57.0
Hydrogen.....	12.0	13.6	11.6	13.4	11.5

This gives the results of the gasification of the five oils already referred to at a temperature of about 1,350° F. Further experiments have been made with all these oils at a variety of temperatures to determine the best results, as measured by the product of the quantity of gas produced into the sum of the percentages of the hydrocarbon vapors and heavy hydrocarbons contained in the gas. Seeing that the illuminating power of the gas is dependent on the two latter quantities, this product may fairly be taken as proportional to the commercial value of the oil for gas making purposes.

The following table gives the best results from each oil, with the temperature at which they were severally obtained:

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It will therefore be seen that the value of a gas oil is practically proportioned to the percentage of paraffines and olefines present; the benzenes and naphthenes being of no value except as tar. The analysis of an oil to determine what percentage of these compounds it contains is not very simple. The aromatic compounds and olefines can be determined by sulphonation, and by the action of bromine and Nordhausen sulphuric acid. The relative quantities of the paraffines and naphthenes may be approximately estimated by taking portions separated by fractional distillation and determining the specific gravity and refractive index.

For compounds boiling at the same temperature, both the specific gravity and the refractive index are much higher for the naphthenes than for the corresponding olefines or paraffines. The specific refraction $\left(\frac{u-1}{-d.}\right)$ is, however, higher for the olefines than for the paraffines; and in this respect the naphthenes do not differ much from the paraffines—at least, for the single ring compounds.

Having thus briefly sketched the lines on which an oil may be examined, I will give a concrete instance of the method of deduction to be employed. Five different samples of oil were taken. They were separated by distillation into a number of fractions, each of which was separately examined. I do not propose to recapitulate the whole of the figures obtained, but simply to indicate the general character of each oil.

The following table will show how they differed one from another:

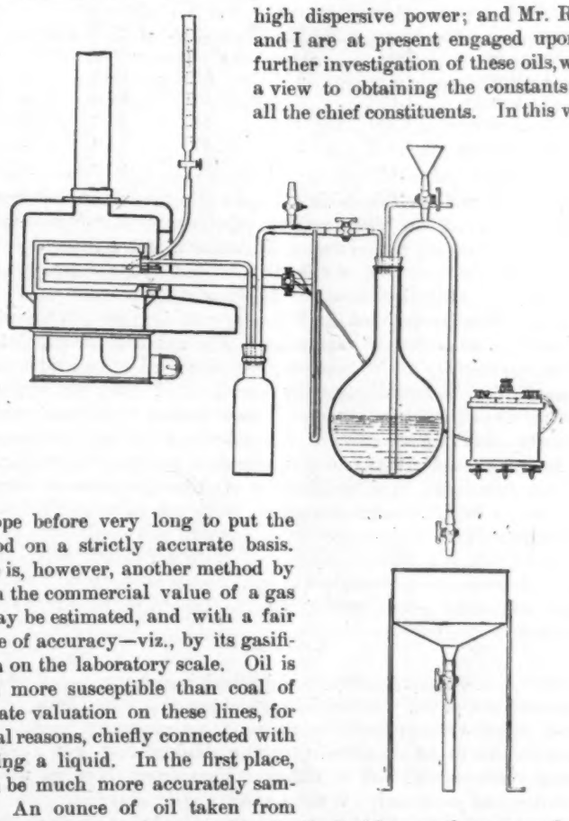
No.	Source of Oil.	Specific Gravity.	Refractive Index at 23° C.	Specific Refraction.	Boiling Point.
1	Russia.....	.825	1.4521	.548	115—300° C.
2	Russia.....	.872	1.4794	.549	200—430° C.
3	America.....	.851	1.4723	.555	150—420° C.
4	Borneo.....	.901	1.5067	.562	170—330° C.
5	Texas	.883	1.4806	.544	200—380° C.

It will be seen that No. 1 oil has a much lower gravity than No. 4, although its boiling point is nearly as high. Nos. 2 and 3 actually boil at a much higher temperature, and yet do not reach the gravity of No. 4; nor is their refractive index so high. A specific gravity of .901, coupled with a boiling point below 330° C., is a sure sign of the presence of closed chain compounds. As this oil, on being shaken with concentrated sulphuric acid, is found to have no appreciable quantity of aromatic compounds, it evidently contains a large proportion of naphthenes.

On comparing the specific gravity and refractive index of No. 5 with the figures for Nos. 2 and 3, similar differences are observed, though not to the same extent as in the case of No. 4. It was also found, on shaking with concentrated sulphuric acid, that about 5 per cent. of the oil dissolved in the acid, showing the presence of that amount of the homologues of benzene. These have a greater effect on the gravity than the naphthenes; but in this small quantity they would not suffice to raise the gravity so high as that found. This oil, therefore, also contains a considerable quantity of naphthenes. When the relation between the refractive index and the gravity—*i. e.*, the specific refraction—is examined, further peculiarities are noticed. No. 5 has the lowest specific refraction; Nos. 1 and 2 give slightly higher figures; while those for Nos. 3 and 4 are much higher. This points to the small percentage of olefines in No. 5, as also in Nos. 1 and 2, compared with No. 3, and to the large percentage in No. 4. This deduction is entirely confirmed by other experiments, in which the amount of olefines was determined in the different fractions by means of bromine, and also by the action of Nordhausen sulphuric acid.

When this method of deduction is applied to fractions of the oil boiling within a small range of temperature, it is possible to calculate approximately the relative proportions of the different constituents. To do so with accuracy, however, it is necessary to know the specific gravity and refractive index of a number of compounds which have not yet been prepared in the pure form. By determining the vapor density of a fraction, and thus deducing the number of carbon atoms in the molecules, it is possible to calculate the specific refraction of the component bodies by Brühl's law.

This law does not, however, give accurate results for hydrocarbons of high dispersive power; and Mr. Ross and I are at present engaged upon a further investigation of these oils, with a view to obtaining the constants for all the chief constituents. In this way



we hope before very long to put the method on a strictly accurate basis. There is, however, another method by which the commercial value of a gas oil may be estimated, and with a fair degree of accuracy—viz., by its gasification on the laboratory scale. Oil is much more susceptible than coal of accurate valuation on these lines, for several reasons, chiefly connected with its being a liquid. In the first place, it can be much more accurately sampled. An ounce of oil taken from a cargo of 1,000 tons is practically identical with any other ounce from the same cargo. Secondly, being a liquid, it can be handled more readily, and can be passed into a retort without loss at any required rate. Thirdly, as the retort has not to be opened for the reception of the charge, the temperature can be exactly regulated.

The apparatus Mr. Ross and I have designed for this purpose is shown on the diagram. An iron retort is heated in a gas muffle furnace to a temperature which is measured accurately by an electrical pyrometer. The oil is passed slowly in by a tube projecting a short distance into the retort; while the gas produced leaves by a tube reaching nearly to the back. The gas is collected, measured, analyzed and its specific gravity determined.

The whole working of the apparatus, together with the following table of the gasification of oils, will be found in the paper already referred to, in the *Journal of the Society of Chemical Industry*.

	Russian Solar Oil.	Borneo Solar Oil.	American Solar Oil.	Texas Solar Oil.	Russian Refined Oil.
Quantity of gas per c.c. of oil, corrected to N.T.P..	465.7 c.c.	301 c.c.	442.6 c.c	397.4 c.c.	429 c.c.
Density (air = 1)	0.833	0.765	0.885	0.737	0.775
Weight of gas made per c.c. of oil	0.502	0.298	0.506	0.388	0.430
Tar by difference, per cent.....	42 5	67.0	40.5	57.0	47.9
Analysis of Gas.	**Per Cent.**	**Per Cent.**	**Per Cent.**	**Per Cent.**	**Per Cent.**
Hydrocarbon vapors.	4.0	4.0	3.2	3.4	3.8
Heavy hydrocarbons	30.2	22.8	33.0	26.8	28.0
Methane.....	54.2	60.0	52.5	56 2	57.0
Hydrogen.....	12.0	13.6	11.6	13.4	11.5

This gives the results of the gasification of the five oils already referred to at a temperature of about 1,350° F. Further experiments have been made with all these oils at a variety of temperatures to determine the best results, as measured by the product of the quantity of gas produced into the sum of the percentages of the hydrocarbon vapors and heavy hydrocarbons contained in the gas. Seeing that the illuminating power of the gas is dependent on the two latter quantities, this product may fairly be taken as proportional to the commercial value of the oil for gas making purposes.

The following table gives the best results from each oil, with the temperature at which they were severally obtained:

No.	Source of Oil.	Temperature Fahr.	Percentage Ungasified (Tar).	Quantity of Gas.	Hydrocarbon Vapors and Heavy Hydrocarbons.	Product.
1	Russia.....	1,510°	39.6	518	28.4	14,711
2	Russia.....	1,360°	42.5	466	34.2	15,927
3	America ...	1,360°	40.5	443	36.2	16,022
4	Borneo ...	1,510°	54.6	472	17.0	8,024
5	Texas	1,350°	57.0	397	30.2	12,001

It is evident from this table that gas oils may vary very greatly in their value, and that before making purchases of oils from new fields the value of the oil should first be determined, and I have ventured to submit the above method of valuation devised by Mr. Ross and myself as a suitable and efficient one for the purpose.

I have thus far assumed that the oils contain no compounds of other elements than carbon and hydrogen. The gas oils usually put before us in this country are in general practically free from acid and basic compounds. In examining a strange oil, it is, however, advisable to determine definitely the absence of these bodies, which can readily be done by observing the effect of shaking with alkali and acid respectively. A further element of importance is the quantity of sulphur. This is best determined by a modification of Allen's method of estimating sulphur in fats. A weighed quantity of the oil, mixed with nine or ten times its volume in absolute alcohol, is burnt in a small lamp under the trumpet tube of a Referees' apparatus; the other details being precisely as in the estimation of sulphur in gas. Samples of "solar" oil tested in this way have given results varying from 0.05 to 0.2 per cent of sulphur.

Discussion.

Mr. G. R. Hislop (Paisley) said he had heard this paper with great pleasure and profit. One could see that the author had gone very carefully into the matter; and the result of his experience ought to be of much value to the members. He (Mr. Hislop) had been working for some years on oil, but on different lines from those on which Mr. Leather had proceeded. What he did was to make illuminating gas pure and simple, and he agreed with the author that considerable differences arose from variations in temperature and volume. In his own case, this had been the real difficulty in getting the best results from his apparatus; but, after four years' working, they had now got fairly in the way of knowing the temperature required for the class of oils generally employed—viz., Scotch oils. He had not had any experience of American, Russian, or Borneo oil, as he obtained an abundant supply from Scotch manufacturers. No doubt they were in the best field in the world for getting the results Mr. Leather had indicated. The fact the author had brought out was the importance of ascertaining the value of oils before purchasing any considerable quantity; and the secret of success depended largely upon knowing the temperatures at which to employ the different oils.

Mr. C. S. Ellery (Bath) said there were two points on which it might be of interest to those who had to use these oils if Mr. Leather could give a little further information, especially now that newer oils were coming into the market. If he followed Mr. Leather, he introduced the oil into the iron retort at the temperatures named, and what he (Mr. Ellery) wanted to know was what would be their behavior on coming into contact with the heated surface—whether there was not a danger of their cracking and liberating the free carbon. He had made a large number of experiments, and the difficulty he found in treating the oils at these high temperatures was that they had stopped pipes, and an interference with the actual determination of the value of the oil. He should also be glad to know what pyrometer M. Leather used, because it was not easy to ascertain these temperatures exactly. However, he seemed to have obtained very accurate figures.

Mr. S. Y. Shoubridge (Sydenham) thanked Mr. Leather for his valuable contribution on a subject about which very little was known. All engaged in the manufacture of water gas felt it was desirable to have a ready means of testing any oils submitted to them. Hitherto they had to buy oils very much in the dark; the only source of information being the persons who had the oils to sell. It was very fortunate that Mr. Leather had devoted his exceptional ability to the consideration of this subject; and he (Mr. Shoubridge) was glad to hear the promise that he had made to continue his experiments, and let the gas profession have the advantage of his further research.

Mr. T. O. Paterson (Birkenhead) said that all who use water gas plant must be much indebted to Mr. Leather for his paper, seeing that carburetted water gas now had an important part in the gas industry, and the oil they were dealing with had a very valuable part in the production of this gas. He must say they had had some very mysterious workings from time to time; but, when they studied this paper, they would perhaps be able to discover something which would enlighten and no doubt benefit them.

Mr. Leather, in reply, said he could hardly expect a very full discussion on his paper; but there was a good deal that might have been added which would have made the paper much longer. But, although in a short compass, on careful reading, the members would see that there was more in it than at first appeared. With regard to the Scotch oils to which Mr. Hislop referred, he had not had a sample of this class submitted to him, nor had he purchased any, because it would probably be out of the question on account of the cost of carriage. If, however, he came across a sample, he should be glad to try it. He believed the Scotch oils had a very large proportion of paraffines, and that the naphthenes would be very low, though they were not altogether absent. A paper read by someone interested in Scotch oil a few months ago, spoke definitely of the naphthenes in their oil, although they evidently had not had sufficient time for a thorough research. He was glad that he was in a position to undertake this kind of work, having a very enthusiastic chemist—the corporation chemist—to aid him, a well fitted up laboratory, and two or three assistants; and he hoped to put a good deal more time into this question, and probe it still further. With respect to Mr. Ellery's question whether the oil coming in contact with a heated surface would overcrack, this was avoided because the retort was kept at a constant and proper temperature as compared with carburetted water gas plant. In the case of heating up the brickwork in the superheater, some portion of the brickwork might be much hotter than others. There were also great variations at the point where the oil went in; the temperature during the time of a five minutes' run varying through as much as 500° and possibly 600° F. They had an Economical Gas Apparatus Construction Company's plant; but the same thing applied to Messrs. Humphreys and Glasgow's. The lower portion of the apparatus, which they called the superheater, was heated up to a high temperature—to a bright yellow heat. The oil was put in above that. The upper portion above the point where the oil entered was, generally speaking, at a fairly constant temperature—about 1,250° to 1,300° F. He put the pyrometer in on one occasion just at the point where the oil was injected. During a three minutes' blow it went up so rapidly that he could hardly follow it. The pyrometer used was contained in a steel case, which protected a porcelain tube, inside which there was a mica frame, on which was wound a fine platinum wire. They really measured the electrical resistance of this fine platinum wire, from which the temperatures were known. It was made by the Scientific Instrument Company, of Cambridge, under Professor Callendar's patent; and the figures were read off direct. There was an indicator, which was strictly speaking a Wheatstone bridge arrangement, with resistances and a circular bridge wire. By turning a knob, a sliding contact was moved, and greater or less resistance put in, until the galvanometer needle balanced; and when this was done, the pointer indicated the temperature. It could be measured, if it did not vary up and down rapidly, to 1°. It was a very accurate instrument, and they had used it inserted in the superheater, as well as in the experimental retort. But when put in at the point where the oil was injected, at the beginning of the blow, the temperature would be considerably below 1,000°. It would go up very fast during the run, and one could hardly keep the galvanometer needle from swaying too much to one side, so as to follow its movements. It read on the platinum scale, and not on the air scale, and varied from about 900° to 1,400° on that scale. Something like 100° would have to be added to the 900°, and about 180° to the 1,400°, to make the calculation for the air thermometer. The cost of the pyrometer was about $35, and of the indicator $78.75 With regard to carbon being formed, the retort was heated up by gas until the pyrometer showed the temperature it was wanted to work at. By this time, the fire casing round was probably much hotter than the pyrometer, but they found that if they turned out the gas at once, and commenced the experiment with the pyrometer, which only took a few minutes, the temperature was practically the same. The oil, at the rate they were putting it in at, took up the heat about as fast as the brick casing gave it out to the retort; and thus there was a fairly constant temperature. Practically there was no carbon formed, except in the case of Borneo oils, and then it had to be cleared out once or twice. Mr. Shoubridge said they wanted some method of testing oils. Perhaps this method was more elaborate than most of them would wish to put in practice; but thay might get very good indications by a Zeiss refractometer, and distilling the oil at different temperatures into different fractions. By trying these fractions in the refractometer (and only one drop was wanted, so that merely a small flaskful need be distilled altogether), the relations between the refractive index of the oil at the different boiling points would at once be seen. If there were a considerable quantity of naphthenes as indicated

by the high refractive index and high specific gravity, they must not expect the oil to give good results. This was only a vague test; but still it was a help. He hoped that, when Mr. Ross and himself had gone on with this work somewhat further, and had got the actual constituents of the oil, they would be able to put the analysis of the oil, apart from testing in the retort, on a thoroughly good basis; and they were certainly trying their best to get it done as soon as possible.

The President said this had been a most interesting paper. He was afraid sometimes the price per gallon of oil was the only thing gas managers looked to in making purchases; and an unpractical mind might easily fall into that error. What, however, they really wanted to know was what there was in the oil which was useful for making gas.

Heating by Gas: A Study of the Gas Radiators of the Societe Francaise de Chaleur et Lumiere.

At the last meeting of the French Society of Gas Engineers M. A. Lecomte read the following paper on the subject named in the heading —for our translation we are indebted to the *Gas World:*

Comparatively little attention has been paid to this subject in France; but heating by gas is simple in practice and its extended use tells very favorably on the gas works, since it tends to steady the demand and utilize the hours of daylight. At the 1900 Congress M. Lévy, of the Paris Company, described the results which had been attained by the Paris Company, and at Dieppe last year M. Lichtfousse gave a brief account of the Kern Burner as used in the gas radiator of the Société Française de Chaleur et Lumiére. The present paper deals with the same gas radiators from a different point of view.

One might ask what difference it could make, if there were no chimney for the escape of the products of combustion, whether the gas were burned with a blue flame or with a luminous flame, since the same number of heat units would in either case get into the room. But it will be seen that it does make a considerable difference.

Calorimetric Experiments.—To find the amount of heat radiated by the above, and the mode of its distribution, we use calorimeters of bright matt-surfaced copper blackened with benzine smoke (Figs. 1-3). These calorimeters have 100 square cm. surface and 1 cm. thickness; Fig. 1 is to be placed vertically in front of the stove, Fig. 2 at 45°, and Fig. 3 horizontally above the stove. The water equivalents of the

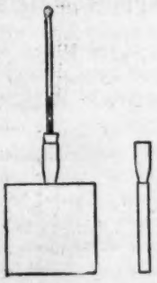


Fig. 1.

Fig. 2.

Fig. 3.

water, copper, and submerged part of the thermometer come to 94 to 96 grammes water. Fig. 4 shows the way in which these calorimeters are

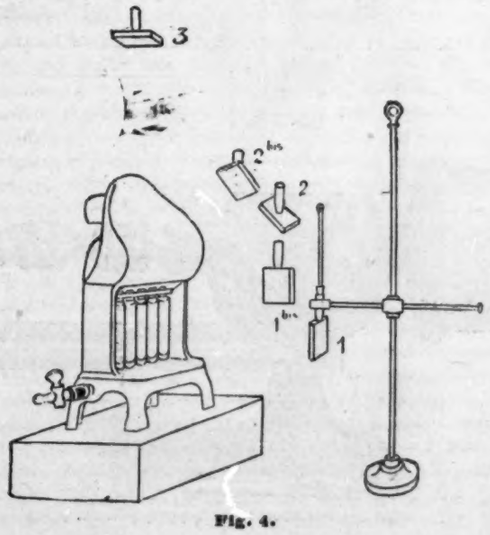


Fig. 4.

ranged about the stove; 1 and 1 *bis* are similar but are set, the one right opposite the stove, the other at 45° to it, and so on. The stove is lit, and the readings of the thermometers in the calorimeters are taken for a certain number of minutes. While the calorimeters are gaining heat from the stove they are also losing it by radiation and convection, and at the same time the amount of this loss is being affected by the gradual rise in the temperature of the room. There are very exact methods of calculating the precise number of heat units really taken in by the calorimeters during the test, but these methods are exceedingly troublesome and are restricted to one calorimeter at a time. We have, therefore, tried to find a readier method of obtaining sufficiently approximate results.

Curves of Cooling.—It is necessary, in the first place, to find the amount of heat radiated in a minute by a calorimeter under a given difference between its temperature and that of the surrounding air; and this can be found by filling the calorimeter with warm water and noting down its rate of cooling, its temperatures being taken, say, once a minute. For example, when the temperature of the room was 16.2° C., the calorimeter was brought to 34° C. In 1 minute, 2, 3, 4 minutes the readings of its thermometer were 33.6°, 33.1°, 32.7°, 32.3°, and so on; and it took 110 minutes for it to fall to 16.2°, since after some 6 minutes the fall of temperature per minute fell to 0.1° C. The time and the temperatures can be plotted out, forming a curve, the curve of cooling. It is found that these curves are exactly the same, say between 40° and 20° as between 34° and 16°; the rate of cooling does not depend upon the actual temperature, but upon the difference at the moment between the temperature of the calorimeter and that of the surrounding air.

Curves of Heating.—If a calorimeter be put up in front of a stove and its temperatures be taken in the same way every minute for, say, 15 minutes, a curve may be plotted out as before; and since this curve is found to be very nearly a straight line the amount of heat taken in is, in the aggregate, very nearly proportional to the time, and is nearly equal during each successive minute.

Calculation from an Experiment.—A calorimeter, No. 1, at 32 inches from the refractory tubes of a radiator (10 tubes), went up in 15 minutes from 19.3° to 26.3°, a rise of 7°. During the same period the surrounding temperature rose from 15.8° to 18.1°, a rise of 2.3°.

To find the loss of heat during the rise of 7°, and the gain due to the surrounding rise of 2.3°, we take the curve of cooling of the particular calorimeter, previously ascertained. Fig. 5 shows this curve; *OA* the

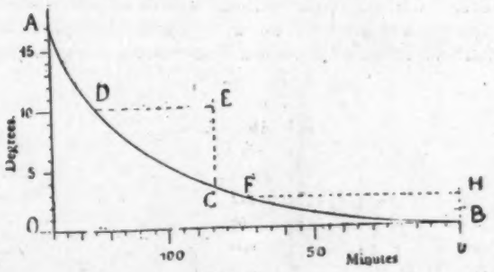


Fig. 5.

over temperatures of the calorimeter and *OB* the time. *C* corresponds to the original difference of temperature (19.3° — 15.8° = 3.5°); draw *CE*, *E* being 7° above *C*; draw *ED*; *ED* shows the time the calorimeter would have taken in falling 7°. The triangular figure *DEC* has an an ascertainable average height. This gives, reckoning above *OB*, the average over temperature *t* of the calorimeter during the experiment. But since the surrounding temperature has risen from 15.8° to 18.1°, an analogous triangular figure *BHF* (*BH* = 2.8°) gives, by the line *HF*, the time necessary for the calorimeter to lose an over temperature of 2.3°, and also by the average height of the triangle *BHF*, the mean amount of heating of the room. This involves finding the area of two triangular figures in order to get the average over temperature of the calorimeter and the average rise of temperature of the room. If the former of these be *t*, we add to it the original difference, 3.5, and deduct the average rise of temperature of the room. Then the loss per minute divided by the mean excess of temperature gives the loss per minute per 1° of over temperature = *A*. The correction then is, for *m* minutes, t_o and t_m the extreme temperatures of the calorimeter, and *T* the final surrounding temperature, $C = m A \left\{ \frac{t_o + t_m}{2} - T \right\}$.

An example worked out on these lines is as follows: Calorimeter rose 19.3° to 26.3° = 7°; mean heating of the room, from the triangle *BHF*, 1.22°; initial temperature difference 19.3° — 15.8° = 3.5°; from this take

1.22° = 2.28°; to this add the mean heating of the calorimeter (from the triangle *FED*, 3.85°), making 6.13° for the mean excess of temperature of the calorimeter. The time of cooling the calorimeter (line *DE*) was 40 minutes for 7°, or 0.175° mean loss per minute. This for the 6.13° brings out, by division by 6.13, 0.0286° as the mean loss of temperature per minute per degree of excess calorimeter temperature.

Then m = 15 minutes; t_0 and t_m are 19.3° and 26.3°; T is 15.8 + 1.22 = 17.2°; and from these the correction C is 2.47°. Finally, the number of heat units (calories) received by the calorimeter is (7 + 2.47) × 60 × 0.099 (for water equivalent) ÷ 15 (minutes) = 3.75 calories. This method is very precise, but very troublesome, and the following method gives very approximate results with great readiness, the error not being more than about 5 per cent. so long as the temperature differences are kept below about 10° C., or 18° F. Temperature gained by calorimeter, 7°; time of cooling, 40 minutes (from curve); time of experiment, 15 minutes; cooling per minute, 7 × 15 ÷ 40 = 2.622; temperature rise in room, 2.3°; time of cooling, 74 minutes; heating of room per minute, 2.3 × 15 ÷ 74 = 0.466. Correction to add, 2.622 — 0.466 = 2.156°. Heat received by the calorimeter (7 + 2.156) × 60 × 0.099 ÷ 15 = 3.63 calories, a result only 3 per cent. out.

Examination of the Air.—Water Vapor.—The amount of water vapor was ascertained from the hygrometric percentage of moisture in the air, coupled with the known amounts which would saturate the air at the actual temperatures.

Carbonic Acid.—Full details are given as to the method of passing the air through a titrated solution of baryta colored with phenolphthaline, and measuring the quantity of carbonic acid absorbed by titrating back the baryta solution.

In a room with doors and windows shut and chimney closed and no outlet for products, the carbonic acid rose in 3 hours with a radiator No. 1 B from 4.41 to 8.45 per 10,000, three persons being in the room all the while; the stove was therefore responsible for 3.34 parts per 10,000.

Carbonic Oxide.—The method adopted was that of MM. Niclou and Grehant, described at the 1900 Congress by M. Levy, but it has been simplified for current gas works use. Fig. 6 shows the arrangement. *A* contains pumice wetted with caustic potash solution; *B* pumice wetted with sulphuric acid; *C* contains crystals of anhydrous iodic acid and can be heated to 150° C. in the mineral oil contained in *D*. *E* is a Cloez washer containing 2 per cent. NaHO solution; and *F* is an aspirator. The CO is oxidized by the I_2O_5; the iodine set free is absorbed in *E*, and by another operation it is subsequently set at liberty, by the addition of nitrite of soda and sulphuric acid, and shaken up with bisulphide of carbon. The depth of the color taken up by the bisulphide of carbon is compared with the color of a series of standards corresponding to known

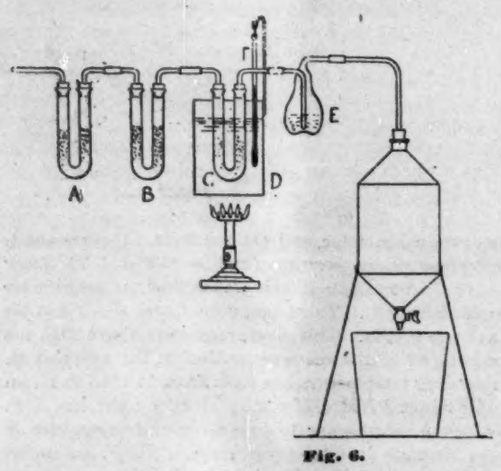


Fig. 6.

percentages of CO. All these operations are promptly carried out, and the method is so sensitive to CO that it is not possible to smoke a cigarette at all in the room without inducing a coloration; and it has served to detect leaks of which the sense of smell had given no indication, by showing a color test corresponding to between one part CO in 70,000 air and one part in 80,000. The actual leak was discovered in the ordinary way the next day. It is striking to find that a gas stove produces, when in action in a close room for 3 hours, less carbonic oxide than is produced by a cigarette.

Mode of Combustion as Affecting Utilization of Heat.—From one point of view it would not matter how the gas was burned, and ordinary gas burners would do as well as stoves. But the products might go right up to the ceiling and carry the heat away with them; so as not to warm the floor for a very long time. Radiant heat is necessary in order to give heat immediately upon lighting the stove. With clay balls and the like there is, however, a tendency to keep back the actual radiation while these massive objects are being heated up to a sufficient temperature. The stoves under consideration produce a flame which is very slightly reducing, almost self-combustible, and the gas may be burned in four ways, namely, with luminous flames, with bunsen flames, with thoria mantles, or with refractory tubes. Numerous experiments were made on these different modes of combustion. The amount of heat thrown forward into the room is greatest with refractory tubes and least with the luminous flame. The refractory tubes seem to act in relation to heat in a way analogous to that in which thoria mantles act for light, and the practical problem seems solved when we can raise the temperature of a room of 2,600 cubic feet capacity by 7.2° F. in 30 minutes with a consumption of 7.4 cubic feet of gas.

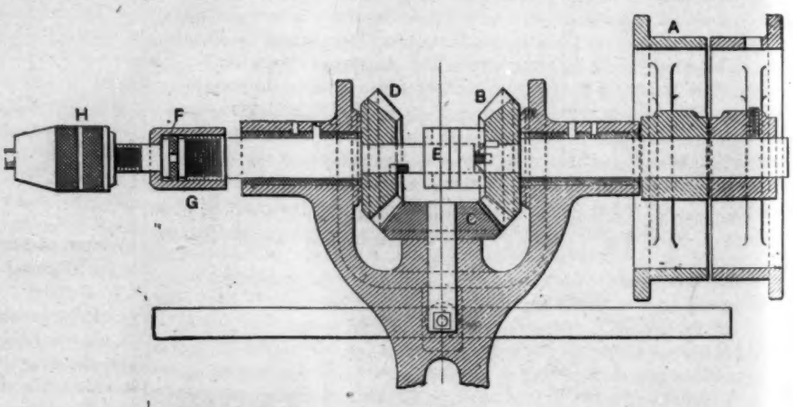
M. Lecomte went on to compare his methods and results with those used by the Paris Gas Company. With a chimney he finds that the results are 20 per cent. lower than they are without one. For periods up to 3 hours he thinks chimneys unnecessary, for the carbonic acid is only raised some 4 parts in 10,000, and the water vapor remains far from the saturation point.

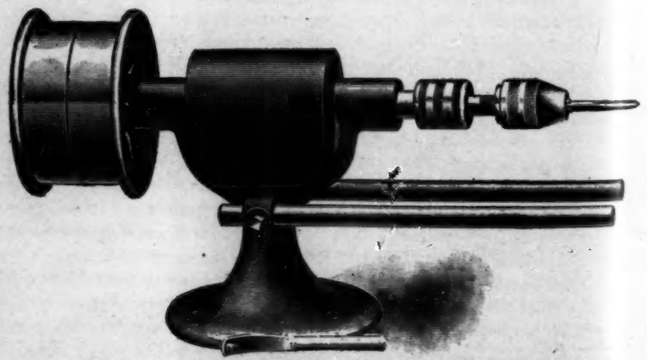
He makes the following remark, as to which it would be interesting to know to what he refers: "Monstrous things have been written about gas stoves. Did we not all of us receive, some 3 or 4 years ago, a prospectus from a French fittings dealer offering an English gas stove called extraordinary, which certainly would have been so had it realized the phenomenon announced in the prospectus; that, thanks to a refractory chamber, the gas in burning decomposed the water vapor contained in the air and that produced by the combustion of the gas itself, so that the hydrogen burned developing an intense heat and the oxygen poured out into the surrounding air to vivify and render salubrious the air? After that there is nothing to do but to take in the ladder."

The stoves under consideration have shown complete absence of carbonic oxide, except on one occasion, where the presence of CO was afterwards found to be due to a leak; the CO_2 was always under 9 in 10,000 and the water vapor under 65 per cent. of saturation. The perforated refractory tube of this stove has, therefore, made its mark and justified its existence.

The Faber Sensitive Bench Tapping Machine.

The illustrations show the construction and appearance of a sensitive horizontal or bench tapping machine that has been devised by A. E. Faber, Jr., of Newark, N. J., for the rapid tapping of light work. The





The Faber Sensitive Bench Tapping Machine.

salient feature of the machine is that holes can be tapped to the bottom without any fear of breaking the taps. The tap holder *H* is carried by the cap *G*, which screws on the end of the spindle. In the cap is the fiber friction *F*, placed between the end of the chuck shank and the driving spindle. The cap is screwed against this friction tight enough to drive the tap to the bottom of the hole, but is not sufficient to break the tap after it reaches the bottom, when the chuck stands still. The device is driven from the pulley *A* through the bevel gears *B*, *C* and *D* arranged as shown. Rigidly mounted on the spindle *E* is a positive clutch member placed between the gears *B D*. Now, when the tap has reached the bottom the operator moves the central clutch member to the left, reference being had to the drawing, when it is brought into engagement with the gear *D*. By this means the direction of rotation of the chuck is reversed and it is withdrawn.

Standard Cement Specifications.[1]

Of the making of specifications, there is no end. This, at least, is the experience of the cement manufacturer, whose material, instead of being tested according to lines thoroughly well settled, as in the iron and steel business and tested at the place of manufacture, as is the practice in other businesses, is subjected to endless variations of tests, which are frequently made thousands of miles away from the point at which the goods are produced. The material tested is not the material that leaves the works, as its form and character are changed by making it into briquettes, test pieces, etc., neat and with sand, and it is subjected to all sorts of manipulations, so that the results obtained frequently vary materially from those made under similar conditions at the place of manufacture. Consequently, there is no industry worse off, for definite specifications, than the cement industry, and none has suffered more than that industry from the lack thereof.

It is with pleasure, therefore, that I am here to address an Association the purpose of which is the standardizing of testing and methods of testing, and it is my pleasure in addressing it to state, in a very general and brief way, some of the disadvantages that the cement industry has labored under during the formative period of tests which has been going on in this country, and some of the many advantages that would accrue as well to the manufacturer, the user and the engineer and architect, by the adoption of standard methods and the correlation of different standards and specifications adopted by the various classes of engineers and consumers using the material.

In my office, I have a large fireproof safe containing many volumes of filing cases, solely devoted to the embalming in fireproof receptacles of specifications that have come to me at various times during my business career. These specifications are of all kinds and of all characters, mostly good but some few bad and indifferent, containing elements of every imaginable description, both as to the requirements and as to the methods of handling the material in arriving at the requirements suggested. This is the mere literary side of cement specifications that I have in my office.

The practical side of this business is at our laboratory at our works. This laboratory, quite a large room, say, 20 x 20 feet, a few years ago was entirely papered on its four walls with cement specifications. One wall was devoted to the specifications of the army engineers of the United States Government, well considered, well thought out and well reasoned specifications, all of them. Another side was almost covered with specifications of the United States navy engineers of the Bureau of Yards and Docks and other bureaus of the same department; all specifications thoroughly thought out, well planned, well conceived. At the other end of the room, the pattern varied somewhat, and there were gathered the requirements as to quality and the methods of manipulation of cement testing to be done by the various railroads of the country. They were more concise, more brief and more to the point, but all of them intelligent, able and well drawn. On the other side of the room, surrounding the door, were grouped a more general gathering of these interesting documents, and embraced what the city engineers all over the country and the engineers of large municipal works in the United States thought should be required of cement, and how it should be handled in arriving at these requirements. Needless to say, this series of patterns embraced a larger variety and covered a larger area of territory, and, like the others, represented careful, hard work, and well conceived and well balanced requirements.

Individually, almost any one of the specifications on the four sides of that room, could be picked out at random, as a fair, reasonable specification of what Portland cement should be. Almost any one of them could be used with advantage and with success and, with few exceptions, any one of them could be carefully scrutinized and nothing seriously ill-judged or unbalanced could be found within its lines.

It is a remarkable tribute to the engineering ability of our country that when all these specifications which covered the four sides of a room and running into the hundreds in number, are gone over carefully, that there are so few which will not stand the test of careful examination and scrutiny, and the conclusion is to be clearly drawn from the facts above stated, that it is not so difficult for intelligent engineers to make a specification containing the proper requirements for fineness, tensile strain, time of setting, constancy of volume and specific gravity and for proper manipulation of the several tests described. Yet with all these facts before us, it is actually possible that within a single year, a single large cement establishment like our own, receives no less than 100 to 150 of different kinds of specifications, varying in most all their elements.

Taking an assortment of specifications at random and in examining all of them to see just how they did vary, I find that, taking the four great classes, the army, the navy, the railroads and the various cities, there were:

In some 25 specifications of various cities of the United States, 7 variations in the item of fineness alone, 14 variations in the requirements of tensile strain, and 6 variations out of 9 requirements in reference to setting time. In the specifications of the army, some 68 in number, I find some 14 variations in tensile strain, 11 variations in fineness, 7 variations in time of setting, and 4 in constancy of volume. In the specifications of the navy, some 7 in number, there were 3 variations in fineness, 5 in tensile strength, with no variation in the time of setting. Among the railroads, of which 8 specifications were found, there were 5 variations in fineness, 5 variations in tensile strain and 3 variations in the time of setting.

As to boiling and hot tests, I took some 35 requirements of these tests gathered from specifications, and out of these 35, in 10 the pats go into water after 24 hours, in 14 the pats go into water after no specified time, and in 11 the pats go into water after setting. Again, out of these 35, in 6 the pats go into steam for 3 hours, in 14 the pats go into hot water for no specified time, in 1 the pat goes into hot water for 3 hours, in 2 the pats go into hot water for 30 minutes, in 1 the pat goes into hot water from 24 to 36 hours, in 8 the pats go into hot water for 24 hours, in 1 the pat goes into hot water for 10 hours, and in 2 the pats go into hot water from 24 to 48 hours. Again, out of these 35, in 21 the pats go into boiling water, in 4 the pats go into a temperature of 212°, in 6 the pats go into a temperature of 176°, in 1 the pat goes into a temperature of 170°, in 1 the pat goes into a temperature of 100°. Finally, out of these 35 specifications, in 13 the pats are to boil for time not specified, in 2 the pats are to boil 30 minutes, in 1 the pat is to boil 3 hours, in 1 the pat is to boil 24 to 36 hours, in 3 the pats are to boil 24 to 48 hours, in 1 the pat is to boil 10 hours, in 5 the pats are to boil 24 hours, in 1 the pat is to steam 3 hours, then stay in hot water 48 hours, and finally to boil 1 hour; in 1 the pat is to steam 3 hours and to boil 48 hours, in 4 the pats are to steam 3 hours and remain in hot water 48 hours, in 2 the pats stay in hot water 48 hours, in 2 the pats stay in hot water at 176° for 24 hours, and in 1 the pat stays in hot water at 110° to 115° for 24 hours. From this it can readily be seen, from the manufacturer's standpoint, that not only the pat, but the manufacturer himself is in "hot water" for all sorts of indefinite periods of time.

Now, just for one moment, imagine the manufacturer's plight while trying to make a cement during the course of a short period in which these specifications were received, which would meet all these different requirements and conditions, and then you can see at a glance how important it is, not only that there should be a standardizing of methods, but that there should be a standardization of specifications. I am happy to say that two departments of our Government have already taken this step, and where one wall was formerly covered with the specifications of the United States army, that wall is a blank with the exception of the one specification [see the *Engineering Record* of September 14 and 21, 1901], recommended by the army board, composed of Major W. L. Marshall, Major Smith L. Leach, and Captain Spencer Cosby, and approved by the United States Engineer Corps. This shows the result of the good work of a very capable force of good engineers.

The other wall, formerly having as its decoration the productions of the engineers of the navy, is to-day practically a blank space, with a single ornament in its center, namely, the small frame containing the specification of Rear Admiral M. T. Endicott, U. S. N., giving the requirements for all the work of the United States navy [see the *Engineering Record* of February 4, 1899]. These two Government specifications are not quite alike but in many of their elements are at least

1. A paper read by Mr R. W. Lesley, Assoc. Am. Soc., C.E., before the American Section of the International Association for Testing Materials.

within "shooting range" and it is possible to meet them, without performing gymnastic feats in manufacturing which were requisite to meet the requirements of the many varieties of predecessors they had on our walls.

We still have with us the railroads and the municipalities. The railroads are taking a step in the same direction as these two branches of the Government, and while there has not been a formally adopted specification of all the railroads in this part of the country, the last convention of the American Railway Engineering and Maintenance of Way Association adopted a tentative specification [see the *Engineering Record* of April 12, 1902], which represents much good work and is in the line of standardization in that department.

The cities and commonwealths of the country, in the execution of their large work, have not yet arrived at the standardization of specifications, but we have hopes that it will come next.

Now, what I want to make clear, after having gone through this underbrush of discussion, is that this Society of our has within its hands a golden opportunity in the field of cement specifications. The army, the navy and the railroads have all gone forward in the proper lines and are practically committed to forms of specifications embracing requirements for the various elements and properties and for methods of manipulation giving reliable results by the respective tests suggested. The American Society of Civil Engineers has appointed a committee to determine upon the proper manipulations of tests of cement, and this committee, several of whose distinguished members are with us to-night, has been laboring with this subject for several years and I understand will shortly report.

Now, our Society cannot, with loyalty to itself or regard for its fellow Society and the engineers of the government and the railroads, undertake to undo or criticize the work that these bodies have done. It cannot with propriety adopt new methods of manipulation while so distinguished a body as the American Society of Civil Engineers has this subject under consideration. It cannot of its own motion set up new standards and new requirements, while the army, the navy and the railroads have come to conclusions of their own on this subject. But this Society of ours, international in its features, can at a time when the export trade in this country in cement is increasing at the rate of 500 per cent. a year, take steps in co-operation with army and navy engineers and the American Society of Civil Engineers, and in co-operation with scientific bodies abroad, to arrive at some method by which a correlation of the specifications of this country and Europe may be reached and results obtained whereby cement manufactured at any point of the world may be tested under similar methods of manipulation and subjected to similar tests at any point where it may be delivered. This cannot be done by independent action, but it must be done by suggestive and persuasive action, and with the support and co-operation of the bodies who have preceded us in the field and have carried out independent investigations on their own lines. It can be best done by the organization, under the auspices of this body, of a cement section, which shall have among its membership representative engineers of the principal consumers of cement, distinguished testing engineers representative of the various well-known testing laboratories, and also representatives of the leading manufacturers. Such a section, comprising in itself representatives of the consumer, the producer and the inspecting engineer, would soon arrive at proper methods for the accomplishment of the object and the work would redound to the credit of all concerned, as well as to the Society of which they are members.

Rates for Electric Supply.

[A paper read by Mr. Louis A. Ferguson, at the last meeting of the National Electric Light Association.]

There is no subject, probably, upon which depends so much the successful financial operation of a central lighting and power company as that of rate making. Whatever advance has been made in this country in determining a proper tariff for the supply of electricity has been one of evolution, and we find the more progressive companies have abandoned the old methods of selling electricity at a flat amount per month or on a basis of discount for quantity only and have adopted some more equitable method of charging.

The necessity for the adoption of an equitable method of charging is becoming more and more apparent, because we hear on all sides the city authorities bringing forward the cry of discrimination, and sooner or later those companies that are not prepared to go before their city council or State Legislature and demonstrate conclusively that the system on which they charge for the supply of electricity is equitable, will be subject to unfair uniform kilowatt hour price regulation.

An equitable method of charging which is based on the underlying principles of the cost of production will not only withstand the attacks of the city and State authorities, but will return to the stockholders of the central station company a fair dividend on their investment.

The advocates of a uniform kilowatt hour price advance the argument that electricity can and ought to be supplied on conditions similar to gas. It is very doubtful, however, if there is any other business carried on under conditions similar to those under which electricity must be supplied.

The production and sale of electricity differ from any other business in that the supply company must manufacture its product only as it is required, and it cannot be commercially stored, consequently the company's plant and mains must be governed by the maximum demand made upon them at any time.

Further, the customers will not wait for the supply and cannot be prevented from taking it whenever they desire.

If the municipality or State should prescribe that a uniform kilowatt hour rate should be charged to all consumers, the effect would be to prevent the extension of the advantages of electricity to all classes in any community, because the price, in order to be sufficiently high to make a fair return on the investment in central station and distribution system, whether it be owned by private or municipal corporations, will necessarily be too high to allow the company to supply electricity to large establishments requiring large quantities of electricity or to small establishments requiring light for a large number of hours daily. Such a uniform kilowatt hour price requires the company to sell its product to some classes of customers at an absolute loss and prevents it from supplying its product to other consumers from whom it might obtain a profit at a price lower than the price required by the municipal or State law.

This point is one that is universally lost sight of by legislators and by advocates of a uniform kilowatt hour price, and to prove it we need only turn to the oft advocated gas analogy. The gas company, with its regulated and uniform price of $1 per 1,000 cubic feet, cannot compete with electricity produced by private plants in large establishments; in fact, it is possible in large mercantile establishments and factories, where the light is required for 8 or 10 hours daily, to produce electricity in a private plant at much less than the cost of gas purchased at $1 per 1,000 cubic feet.

The central station company manufacturing electricity and selling its product on an equitable basis, discriminating justly in its tariff between the profitable and unprofitable consumer, may extend the advantages of electricity to the entire community, selling its product at a high rate to the customer using the company's investment for a short period daily, and at a lower rate to the consumer using the company's investment for a long period daily. A central station company operating under such a system of rates is able to obtain a reasonable and fair profit from all classes of customers and does not exact an excessive profit from one class of customers to make up for the loss incurred in supplying the uprofitable class.

The courts have determined, as to other lines of public service, that discrimination is lawful provided it is not unjust, and it certainly can be proven that any discrimination in the rates for the supplying of electricity which is based upon the cost of the supply of electricity to the customer is just; and it is my further belief that it can also be proven that the method of charging a uniform price per unit of electricity supplied, which bears no relation whatever to the cost of production, should be classed under the head of unjust discrimination, and therefore prove less fair and less reasonable than an equitable and variable tariff based upon the cost of production.

For the first five years of the operation of the Chicago central station companies it was their practice to charge a uniform list rate per kilowatt hour, with varying discounts ranging up to 20 per cent., depending upon the quantity of electricity supplied. It was soon found necessary in many instances, in order to retain the business, to increase the discount. This was especially true in the cases of large customers, and the writer about nine years ago, in order to establish a more definite and satisfactory system of dealing with customers, devised a form of contract which embodied an agreement on the part of the customer to use the company's service to the exclusion of all other methods of artificial illumination for a period of from one to five years. The discount allowed from the list price in each of these contracts was fixed for the term of the contract, and was determined by the character of the customer's load factor, which was estimated in advance. A minimum monthly or annual payment was guaranteed the company by the customer, the amount of the minimum in every case approaching as nearly as possible the anticipated net bills.

The company, through this method of charging, made very rapid progress in interesting large customers in the central station service, and was remarkably successful in convincing owners of isolated plants of the advisability of abandoning their operations and adopting the company's central station service.

It soon became evident, however, that in an extensive lighting and power business, such as is to be obtained in Chicago, that the method we had been employing with large customers could not possibly be applied to all our customers, as the load factor of each could not be predetermined with accuracy and a large corps of assistants would be required to properly handle the business of rate making, so that it might be fair to all customers alike, and profitable in all cases to the company.

We experimented with the system of charging based upon the number of hours' use of the connected load, and as might be anticipated this proved to be only a makeshift and had only limited success since it was lacking in correct principles and bore no relation whatever to the cost of production. The minimum guarantee per lamp connected prevented the installation of lamps in places where they might be used only intermittently and thus limited the advantages of the use of electricity, especially in the home.

Realizing the necessity of a general system of charging which would be commercially sound in principle and not only equitable for all classes of customers, but would also be automatic in its action, we decided to employ that system which seemed to afford the best solution of the problem, of allowing a reduction in rates and at the same time provide a fair return to the company from all classes of customers for the service rendered. Our success with the load factor and minimum guarantee system as employed with the large customers, together with the full realization of the principles underlying the cost of supplying each customer, led us in 1897 to adopt for all new business and for the gradual readjustment of our existing business the Wright demand system in a modified form.

The system as employed in Brighton, England, while admirably adapted to the customs of the English people and the conditions surrounding a municipal corporation, was considered unsuited to the commercial methods prevailing in this country, and it was decided that the system should be Americanized.

To fill the requirements of American conditions the writer suggested the method of basing each monthly bill upon the customer's actual maximum in that month, and to charge the full rate of 20 cents per kilowatt hour during each of the six winter months for all electricity consumed monthly until the consumption reached the equivalent of 45 hours' use of the maximum number of lamps lighted simultaneously as indicated by the Wright demand meter, and to charge 10 cents per kilowatt hour for all electricity consumed in excess of that amount.

During the six summer months, however, the full rate was charged for all consumption until it reached the equivalent of 15 hours' use of the maximum number of lamps lighted simultaneously, and for all electricity in excess of that amount the rate of charge was 10 cents per kilowatt hour.

The net rate obtained from this method, with the rates employed, would, of course, be too high for large consumers, and a wholesale discount was offered, the discount being taken only from the low rate portion of the bill, the amount of this wholesale discount ranging from 5 per cent. to customers whose low rate portion was $100 and increasing by 5 per cent. for each $100 of the low rate portion, making the maximum discount 50 per cent. in the case of a customer whose low rate portion was $1,000.

We have within the last year simplified our method of charging by abandoning the difference between the summer and winter rates. We now charge the full rate of 20 cents per kilowatt hour for the equivalent of 1 hour's daily use of the maximum demand throughout the year, our reason for the change being that we found it objectionable to increase the rate of charge by the increase of hours in the fall months, just at the time when the consumer was beginning to use a larger quantity of electricity.

The method of charging the power business is as follows: The full rate is 10 cents per kilowatt hour for the first 30 hours' use of the maximum power per month.

Low Rate.

8	cents	per	kw.	hour	for the second 30 hours'	use.
6	"	"	"	"	third 30	"
4	"	"	"	"	next 450	"
3	"	"	"	"	" 180	"

The low rate of the bill is subject to the following discount;

From	$20 to	$40	15 per cent.
"	40 to	60	25 "
"	60 to	80	30 "
"	80 to	100	35 "
"	100 to	200	40 "

These rates for power give a range from 10 cents to 2.88 cents per kw. hour as a minimum.

Since the system was put into effect in 1897 we have kept very complete statistics showing the income at the different rates of discount. We have in use in Chicago at the present time a total of 13,022 Wright demand meters and 15,633 recording meters, the income from the customers using Wright demand meters being $986,560 for the fiscal year ending March 31, 1902. The average discount from the list is 35.1 per cent. for light and 49.1 per cent. for power. Of the Wright demand meters 94 per cent. are 25 amperes and under, showing that the bulk of our business on this system is with relatively small customers.

The total number of customers on our books is 18,623, of which 61.7 per cent. are on the Wright demand system.

At the end of our fiscal year, March 31, 1902, we had 2,737 power customers, of which 50.7 per cent. were on the Wright demand system.

The total investment in meters of all kinds on the company's system is $353,000, of which 23 per cent. is for the Wright demand meters. The load factor for the Chicago Companies for the last fiscal year was 27.1 per cent., showing an average daily use of the system's maximum of 6½ hours.

The total yearly expense per recording meter in 1897, including the salaries of superintendent, bookkeeper, inspectors and helpers, miscellaneous supplies, repairs and renewals (before we adopted the Wright demand system of charging) was $2.95 per recording meter.

In the year 1901 the total yearly maintenance expense per recording meter, including the same items, was only $1.85 per recording meter, showing that the cost of maintaining Wright demand meters is inconsequential.

Criticism has been sometimes made of the method used in Chicago on the ground that the company might do a large amount of unprofitable business, owing to the fact that there was no guarantee to the company that the consumer would pay for at least one hour's daily use of the maximum demand. An analysis shows that of our total income from Wright demand business, only 8.6 per cent. of the total comes from customers using the equivalent of their maximum demand for less than one hour daily, and, further, that the ratio of gross bill to full rate lamp hours of these "shortage customers" is 57.3 per cent., so that the actual amount of business which falls short of using the maximum demand one hour per day is only 3.67 per cent., which, I think, may be considered small enough to be unworthy of criticism.

The ordinance under which we operate in Chicago provides that we shall not charge at a rate higher than 1 per cent. per 16-candle power lamp hour, so that we are prevented from exacting from our customers a guarantee that they will use the maximum demand at least one hour per day; but even though we were not prohibited by the ordinance, it is very doubtful whether we would consider it wise to exact this guarantee from the customer in view of the small percentage of shortage that actually exists in practice, for such exaction from the customers by the company is often the cause of bitter feeling and undesirable criticism, and sometimes results in unfair legislation, which more than offsets the small gain in revenue exacted by the company under the minimum guarantee.

The full rate portion of a customer's bill should, under no circumstances, be subject to discount, as in all equitable tariffs each customer should pay the cost to the company of preparing itself to supply the demand.

The cost of supplying electrical energy from a central power station may be separated into two clearly defined groups:

1. The cost of getting ready to supply and distribute energy.
2. Cost of continuing the actual supply of energy.

These two groups may be designated as "preparation" and "production" costs respectively.

In the manufacture and distribution of electricity from a central station the preparation costs form by far the greater percentage of the total cost, and each customer must use the service of the company a sufficient length of time daily at the full rate of charge to insure the company against actual loss. After the customer has used the service of the company a sufficient length of time daily to insure the company against loss, then the company may sell the consumer the balance of the electrical energy required by him at a fair margin above the production cost to insure a reasonable profit on the investment.

I believe, however, that the initial rate should be maintained as high as possible, and if it is found desirable to lower the charge covering

preparation costs it should be accomplished by reducing the length of time daily that the customer is required to use the maximum demand before obtaining the benefit of the low rate. This will lessen the amount of shortage from a certain class of customers.

The use of an indicator for determining the maximum demand, without limiting the same, eliminates all speculation and discussion as to the probable maximum demand of the customer, and puts the rate making in each individual case entirely in the customer's own hands, for the company installs the meter and the customer makes the rate by the manner in which he uses the service.

The value of a system of charging which places the rate making in the customer's hands, and eliminates all trading, as this does, must appeal strongly to one who has had much experience in making rates and negotiating contracts with a large variety of customers; and from 5 years' experience gained with this system, I am more strongly convinced of the necessity of some such equitable tariff being adopted by all the electric lighting companies in every city and town, not only to serve justice to the customer but also to protect the investor in illuminating properties from the loss of revenue resulting from injudicious contracting, so common, especially in the smaller cities and towns, and unfair municipal price regulation, both of which will become inevitable without a proper system of charging.

Physical Extent of the Universal Exposition, St. Louis, 1904.

The scope of the St. Louis World's Fair as affecting the interests which will exhibit in the Department of Manufactures may perhaps be gauged by its physical magnitude. In this particular one can hardly overestimate its superiority as compared with all preceeding Expositions. The site of the Exposition, alone, represents a value of $15,000,000. It is located about 6 miles (30 minutes ride) from the heart of the business district of St. Louis and embraces 1,200 acres.

The buildings will provide 200 acres of space for exhibits under roof, twice as much as offered by any exposition ever held in any country. Of this acreage under roof, there has been assigned to the Department of Manufactures 3 buildings which have a combined area of about 1,500,000 square feet of exhibit space. The importance of this to the manufacturers of the world will be more fully appreciated when it is understood that this is all ground floor space and that there will be no galleries in the 3 buildings of the Department of Manufactures. To thus have all exhibits on the ground floor has necessitated buildings one-quarter of a mile long; but the policy of the officers of the Exposition has been not to allow any question of expense or difficulty to interfere with the general plan of the Exposition, as they are determined to hold in St. Louis the greatest and most successful of all international exhibitions. It is probably the immensity of the undertaking of the St. Louis Universal Exposition that has done as much as anything to secure the co-operation of the leading governments of the world and the hearty support of all the States and territories of this country.

The location of the city of St. Louis is most favorable, geographically, for an exposition. It is about midway between Maine and California and lies half way between the Great Lakes and the Gulf of Mexico. It has 50,000,000 people within a 24 hours' railroad ride in all directions (New York city has but 34,000,000 within a similar radius) and it is the terminus of 24 railroads. It is the fourth city in size in the United States, having a population of over 600,000—has 62.5 square miles of territory, 20 miles of river front and 7,000 factories.

The Cumming Portable Forge.

A forge that is remarkable for its simplicity is shown in the illustration, and it is being put upon the market by David W. Cumming, of Chicago, and George Cumming, of San Francisco. The latter is the inventor of the device.

The blower and working parts are inclosed and protected. It is a compact machine, giving a strong blast, easily produced and maintained for some time after the application of power has ceased. The forge is made almost entirely of wrought iron and steel and is practically proof against breakage. A tuyere pipe, a basin or hearth, a blower, a set of legs or stand and a shield, each well designed and proportioned, are assembled to make the forge. This forge is easily and quickly taken apart and as readily put together again. This dismembering and reassembling feature is a desirable and convenient one when it is necessary to use the forge in a place to which there is a restricted passage, or in taking it from place to place—down a mine, for instance, or to the face of a drift.

Production of Petroleum.

In his report on petroleum, which will be found in the forthcoming edition of the "Mineral Resources of the United States," Mr. F. H. Oliphant invites attention to the following conspicuous features in the production and sale of petroleum in the United states during the year 1901. He notes that the production of crude petroleum was greater than that of any previous year; and that there was a very remarkable increase in the production in the States of Texas and California, a decrease in the production of the Appalachian or Eastern petroleum fields, and a slight gain in the output of the Lima-Indiana region. Of the total production in the United States 80 per cent. came from the older Appalachian and Lima-Indiana fields, leaving 20 per cent. to be made up from all the other fields; this amount is 11½ per cent. greater than the proportion furnished in 1900 by the other fields. There was a slight decrease in the number of wells completed in most of the important fields, and stocks held in the Appalachian and the Lima-Indiana fields were also slightly decreased. There was an average decline of about 2½ cents per barrel for crude petroleum at the wells in 1901 as compared with 1900. The exports of petroleum and its products increased and were larger than ever before recorded, although there was a slight decrease in their total value. The year was conspicuous for the new pools found and for the new production in the Southern and Western States, which was followed by the organization of an immense number of petroleum stock companies representing many millions of capital.

The total production of crude petroleum in the United States in 1901 was 69,389,194 barrels, being larger than that of any previous year. It was larger by 5,768,665 barrels, or 9 per cent., than the production of the year 1900. The increase in the production of 1900 over 1899 was 6,291,854 barrels, or 11 per cent., and the increase in 1899 over 1898 was 3 per cent., or an average gain of 7.7 per cent. for the last three years.

As compared with the value of the total production of 1900, 63,620,529 barrels, valued at $75,989,313, the total production of 1901, 69,389,194 barrels, valued at $66,417,335, shows a decline of $9,571,987. In the order of production Ohio comes first, with over 21,000,000 of barrels; West Virginia second, with over 14,000,000 of barrels; Pennsylvania third, with over 12,000,000 of barrels; California fourth, with over 8,000,000 of barrels; Indiana fifth, with over 5,000,000 of barrels; Texas sixth, with over 4,000,000 of barrels, a loss in production, as compared with 1900, for Ohio, West Virginia and Pennsylvania, and a gain of nearly 4½ millions of barrels for California; of a little over 3½ millions of barrels for Texas, and of nearly 900,000 barrels for Indiana. This production for 1901, by fields, was in round numbers for the Appalachian field, 33,600,000 barrels; the Lima-Indiana field, 21,900,000 barrels; the Southern California field, 8,800,000 barrels; and for the Texas field, 4,400,000 barrels.

The quality of the petroleum produced from these new sections is generally much inferior to that produced in the old fields, but the greater part of it is valuable as a fuel in its natural state, or after some of the more volatile products have been removed, and is particulary acceptable as fuel in the absence of available coal deposits in the Southwest and

West. In 1901, the Appalachian field produced 48.45 per cent. of the total output, the Lima-Indiana field 31.61 per cent., and all other fields 19.94 per cent., as compared respectively with 57.5 per cent., 34.34 per cent., and 8.61 per cent. in 1900. The new fields of California, Colorado, Kansas, Wyoming and Texas, it is observed, produced practically 20 per cent. of total production of 1901, a gain of 11.4 in percentage over 19.0, with the probability that the Southwest and West will produce 35 per cent. of the total output in 1902.

The average price paid for all the petroleum marketed in the United States during 1901 was 95.7 cents per barrel, as compared with $1.194 in 1900, showing a decrease of 23.7 cents per barrel or 20 per cent., the lowest price since 1898. The gross decrease in value for 1901, as compared with 1900, was nearly 13 per cent., notwithstanding that the quantity increased for the same period a little over 9 per cent. The average price paid for Pennsylvania petroleum, which represents 48.5 per cent. of the total production, was $1.21 per barrel in 1901, as compared with 57 per cent. produced in 1900 and marketed at an average price of $1.356 per barrel, a decline of 14.6 cents per barrel, or 12 per cent. There was a decline of 37.7 cents per barrel in the average price paid for California petroleum, and a decline of 76 cents per barrel for the Texas product in 1901, as compared with 1900—a decline accounted for by the increased production of the new fields developed in both these States.

The total number of wells completed in 1901 in the United States in the search for petroleum approximates 14,250, of which 3,220 are estimated to be dry. The cost of these 14,250 wells is estimated at $21,375,000, approximately one-third of the receipts for the entire crude product.

In 1901, for the first time in the history of the trade, the total number of gallons of petroleum and its derivatives exported exceeded 1,000,000,000, the number of gallons being 1,062,750,306, a gain of 9 per cent. over the exports of 1900. The value of these exports in 1901 was $71,479,124, as compared with a value of $73,276,282 in 1900. The total exports of manufactured petroleum from Russia in 1901 was 390,920,095 gallons, about 36.8 per cent. of the exports from the United States.

The average price received for all the various grades of petroleum exported from the United States in 1901 was 6.73 cents per gallon, as compared with 7.52 cents per gallon received in 1900 and with 6.83 cents per gallon in 1899. The developments of the oil pools at and near Beaumont, Tex., and in the section surrounding Bakersfield, Cal., and the developments at Boulder, Col., have been the chief causes of the organization of 1,578 oil stock companies with a capitalization, acknowledged and estimated, of $669,083,000 in 1901.

New York continued to be the leading port for the export of petroleum and its products during 1901. Of the total amount shipped abroad, about 56.66 per cent. was sent from that city, 30.75 per cent. from Philadelphia, 8.75 per cent. from Delaware ports, 3.75 from Baltimore, and less than one-tenth of 1 per cent. from Boston. It is estimated that 45 per cent. of the entire product of the crude petroleum produced in the United States finds a market abroad, notwithstanding the high duties that are imposed by almost all countries, except Great Britain, upon all imports of our petroleum. This fact seems to indicate that no other artificial source of light can replace petroleum in the markets of the world.

The Totten Aluminum Soldering Compound.

The *Metal Worker* notes that amongst the many soldering compounds for aluminum that have been put upon the market, is the compound offered by the Whaley-Totten Company, of Buffalo, N. Y. The inventor claims that this solder can be used with the same simplicity as the ordinary tinsmiths' solder, the observance of only a few things being necessary to secure success, The compound is said to contain a sufficient proportion of aluminum to prevent its discoloration, so that it does not present any difference in appearance from the metal of the articles on which it is used. It will join all the alloys of aluminum as well as pure aluminum, and will also solder aluminum to iron, copper, brass and malleable iron, as well as any of these materials together.

In use it is only necessary to provide a clean surface when soldering aluminum, as the compound carries sufficient flux to secure a connection with the parts to be united. It is best to provide a large soldering copper especially for this work, which, after being forged to suitable shape and filed, should be coated with the compound in the same way that the tinsmith tins his copper. The soldering copper used for the Totten compounds should not be used with ordinary tinsmith's solder, but should be reserved for aluminum work only. Owing to the excessive heat conductivity of aluminum the soldering coppers should be heated to a greater proportionate degree and to an extent adapted to the thickness of the aluminum to be soldered. As a usual thing a cherry red heat will secure the best results, but experience will soon determine what heat will be the most effective under varying requirements. When soldering aluminum no flux is required, nor is any scratching necessary, as it is claimed that the solder carries with it a sufficient flux to get under the oxide and make the solder adhere strongly to the surface of the aluminum. The claim is further made that an aluminum article soldered with the Totten compound will show no tarnishing or oxidiation at the point of soldering, and the soldered parts will not be affected by moisture, acids or the action of boiling water.

The manufacturers state that this compound is the only one that will take thoroughly on steel or malleable iron, when a flux of muriatic acid, cut with zinc, is recommended. The flux, however, is only necessary on other metals than aluminum. The company issue a circular explaining the properties and merits of the Totten soldering compound and containing testimonials from those who have used it.

ITEMS OF INTEREST FROM VARIOUS LOCALITIES.

Mr. James W. Dunbar, Secretary and Treasurer of the Western Gas Association, has been elected M. W. Grand Master of Masons in the State of Indiana.

Messrs. Graham, Morton & Co., of Leeds, England, whose system of inclined retort construction has met with great favor in Europe, have just been awarded an important contract for an installation of their system in Paris, France. Messrs. Adam Weber Sons, of this city, are the representatives of Messrs. Graham, Morton & Co., in the United States and Canada.

The capital stock of the Calumet Gas and Electric Company of Chicago has been increased from $50,000 to $500,000.

R. G. Webster is informed that the interest for the half year, on the 6 per cent. bonds of the Annapolis (Md.) Gas and Electric Light Company, has been payable since the 1st inst. at the office of the Baltimore Trust and Guarantee Company.

Mr. John Werry has resigned the office of County Register of Nevada County, Cal., in order to accept the position of Manager of the Grass Valley branch of the properties of the Nevada County Gas and Electric Company.

Messrs. Bartlett, Hayward & Co., are to construct a gasholder for the Citizens Gas Company, of Terre Haute, Ind. The rated capacity of the vessel is 750,000 cubic feet. It is to be constructed on a site recently purchased by the Company at First and Swan streets, and it is to be completed by December 1st. Superintendent Diall has heretofore been greatly hampered through lack of storage accommodations.

Special despatches to the newspapers, dated at Trenton, N. J., last Monday had this to say: "Upon the complaint of Frank L. Day and Henry B. Day and William H. Remick against the Bay State Gas Company of New Jersey, Judge Kirkpatrick in the Circuit Court today appointed George D. Hallock, of North Plainfield, receiver of the corporation. The Bay State Gas Company of New Jersey was organized in February, 1899, and capitalized at $1,000,000, to be held by the Bay State Gas Company of Delaware, whose capital stock is $100,000,000. It is pointed out that in January, 1899, J. Edward Addicks and William E. L. Dillaway and the Bay State Gas Company entered into an agreement with the Mercantile Trust Company for the issue of bonds, from the proceeds of which it was proposed to purchase stock of the Boston Gas Light Company, the Roxbury Gas Light Company, the South Boston Gas Light Company, and the Bay State Gas Company of Boston. It is charged that the New Jersey and Delaware Companies defaulted under the trust agreement, and that they have failed to pay to the trustee any moneys for the redemption of certificates which expired April 2, 1902. The amount due at that time was $90,000, and under the agreement this sum was due to be paid by the Delaware Company to the New Jersey Company March 21, 1902, which amount was to be used in the creation of a sinking fund. The default in the creation of the sinking fund having continued for 3 months the bill says it now comes within the power of the holders of bonds to require the trust company to declare the principal of all bonds of the first series due. The nominal amount of said bonds now outstanding is $8,159,500. The bill charges that the amount of interest due on the first series is $278,987. It is further charged that the New Jersey Company, in violation of its

covenant, has permitted the Massachusetts Gas Companies to create, between June 30, 1899, and June 30, 1901, a floating indebtedness to the amount of $333,000. It is charged that the four Massachusetts Companies, whose stocks are pledged as security, have not for two years earned or declared sufficient dividends to pay the interests on the bonds, and this, together with the pending Boston gas war, has seriously diminished the market value of the stocks and would prevent their sale now or in the near future for a price at all adequate for the payment of said indebtedness."

THE people interested in the proposed gas works for Berwick, Pa., are largely concerned in the affairs of the Home Gas Company, of Steelton, Pa.

THE Warren (O.) Gas Light Company will make many additions to its main system this season.

THE Pennsylvania State Board of Taxation has put the assessment of the Atlantic City (N. J.) Gas Company at $55,000. The local assessors had valued the property for purposes of taxation at $175,000.

THE users of natural gas in Greenville, O., have been notified that after the 1st day of October gas will be supplied through meters only. The rate has been fixed at 20 cents per 1,000 cubic feet.

MR. J. H. CARDALL has been appointed Superintendent of the Huntsville (Ala.) Gas Light Company. The new proprietors of the Company propose to reconstruct the plant.

THE plant and franchises of the Albion (N. Y.) Gas Light Company have been purchased by the operators of the Albion Electric Light Company.

MR. C. H. BEARDSLEE, Secretary of the Cleveland Gas Light and Coke Company, has taken unto himself a bride, in the charming person of Mrs. M. Robinson Whitehead. The ceremony was performed in Pittsburg, Pa., the 26th ult.

CAPTAIN JOHN W. HALL, formerly President of the Consolidated Gas Company, of Baltimore, has refused to run on the ticket nominated for the Board of Directors of the Company by the committee of stockholders. The latter have named in his stead Mr. Chas. T. Crane, President of the Farmers and Merchants National Bank.

AT a meeting of the shareholders of the Springfield (Mass.) Gas Light Company, held at noon of Friday last, it was voted to increase the capital stock from $500,000 to $750,000. Of course, the proposed increase must be sanctioned by the Board of Gas and Electric Light Commissioners.

MAYOR F. R. AUSTIN and the other local rulers of the Borough of Tuckerton, N. J., are inviting tentative proposals for the establishment of a gas works. The Borough will agree to pay for public lighting to the amount of $1,200 per year.

THE authorities of Kensington, Md., have passed an ordinance granting the proprietors of the Kensington Light, Heat and Power Company the right to operate a gas works. The town agrees to take gas for public purposes equal in value to $600 per year.

MR. ROBERT T. TODD, formerly Second Vice-President of the Cincinnati Traction Company, has been appointed General Manager of the traction lines recently acquired by the United Gas Improvement Company in Rhode Island. The mileage of these roads is considerably over 300.

THE Suburban Gas Company, which was organized for the purpose of supplying gas for light, heat and power in the boroughs of Delray, Woodmere and Springwells, Mich., has completed its plant, and is now actually transacting business. The officers are: President, M. Leibel; Vice-President, H. T. Ammon; Secretary, J. P. Cowing; Treasurer, M. F. Bramley.

THE mains of the Marlboro (Mass.)Gas Company are to be extended to the village of Hudson, which will require the placing of something over 4 miles of pipe. Mr. R. P. Hurlbut will have charge of the Company's affairs in Hudson.

MR. DANIEL O'DRISCOLL, for many years in the service of the old New Orleans (La.) Gas Company, died the night of June 28th. He was in his 56th year.

MR. J. W. TILFORD, of Nashville, Tenn., is still bargaining with the authorities of Monroe, Wis., for the right to establish a gas plant there.

THE proposition to establish a gas works in Shenandoah, Ia., a franchise for which was granted to Mr. C. J. Hayes and associates, was submitted to the voters for ratification some days ago. A total vote of 298 was cast, only 4 of which were in the negative.

THE ordinance granting the East Ohio Gas Company the right to furnish natural gas to the residents of Cleveland has been signed by Mayor Johnson. The purpose of the proprietors of the Company is to pipe the gas from West Virginia. A peculiarly unfair provision in the franchise is to the effect that should the supply of natural gas fail, artificial gas, or a mixture of natural and artificial gas, may be supplied.

THE residents of Anthony Park, a residential suburb of St. Paul, Minn., have appealed to the St. Paul Gas Light Company for a supply of gas. President A. P. Lathrop, of the Company, says that the supply will be laid on provided a reasonable number of the residents will agree to purchase gas; "for," said President Lathrop, "the residents of the Park, in putting up their homes, were possessed with the idea that the houses should be kept as far apart from each other as possible."

THE Philadelphia Gas Company has absorbed the South Side Gas Company, of Pittsburg, Pa., and the selling rate has been reduced to $1 per 1,000 cubic feet, a concession of 20 cents per 1.000.

THE proprietors of the St. Joseph (Mo.) Gas Company have determined to construct a handsome office building. It is not likely, however, that work thereon will be commenced before next year.

IT is likely that the U. G. I. Company will come into complete ownership of the Harrisburg (Pa.) Gas Company before August 1st.

THE following is from the New Haven (Conn.) *Journal-Courier* of the 3d inst.: "Officers of the New Haven Gas Light Company said last evening that the issue of debenture bonds to the extent of 60 per cent. of the Company's capital stock, which has just been voted by the Company's Board of Directors, was to be used in betterments and extensions mostly in New Haven and immediate vicinity. These debentures, which will amount to $750,000, are to run for 5 years, and are to be converted into stock of the Company on October 1, 1907. They are to bear interest at the rate of 4 per cent. One-half of the above sum is to be subscribed on October 1 next, and the other half in April next. The debentures are to be issued the same as the stock to the stockholders, pro rata with the present holdings. The funds thus raised are to be used mainly in extending the lines of the Company in this city, and for the construction of the new water gas plant now building, for the erection of a new holder at the gas works, a new purifying house and apparatus and possibly a new retort house. Besides there is the balance of payments upon the Woodmont extension to be paid for, although this has been largely paid up. The Company also contemplates laying an extension to the Country Club, this to be completed in the fall, and will make other extensions. The shareholders of the Company will no doubt avail themselves of the privilege to be offered of subscribing for the bonds, which, as stated above, are convertible into stock at the end of 5 years after being issued. They will be convertible into stock at par. The Company's capitalization is small compared with the magnitude of its operations or as compared with a host of corporations whose stock is dealt in in Wall street in which great amounts of water have been injected. It is a home corporation which is and has been managed on strictly conservative lines with no stock watering processes. A large amount of new improvements has in fact been made out of the Company's earnings. Now, with the big outlays for improvements which the Company of late has been making and is now making or is contemplating in the near future, an increase of its capital is required and this is being done along conservative lines in keeping with the Company's time honored record. The 8-mile extension of the Company's lines to Woodmont is an important development and is in line with the progressive yet conservative policy of the Company which has voluntarily reduced the price of gas until it is at a point that compares favorably with that of any gas company in the country. The Company has just extended its pipes into the borough of Fair Haven East and last Tuesday night the streets of Fair Haven East were lighted by gas for the first time in the borough's history, and the reign of the old time oil lamps for street lighting there is over and relegated to the past, the only exception being the use of the old oil lamps at very few points where the laying of gas mains has not yet been finished. The Company now furnishes 70 street gas lamps for this section of New Haven

(*Continued on page* 49.)

THE AMERICAN GAS LIGHT JOURNAL

A. M. CALLENDER & CO.,
PROPRIETORS.

THOS. J. CUNNINGHAM,
ELBERT P. CALLENDER,
EDITORS.

MONDAY, JULY 14, 1902.

(*Concluded from page* 48.)

barring the few exceptions noted. East Haven is now supplied with gas by the Company as far as East Haven green, and Cosey Beach would have been supplied this season if the Company could have obtained the pipe for the purpose. The Company has ordered 2,200 tons of pipe this year, most of which has been received. There has been much difficulty in getting orders for pipe filled and much delay was caused in the Woodmont extension work on this account. The Company is making 40 or 50 different extensions of its lines in and about the city. By the laying of larger mains in West Haven as a part of the extension of the service through to Woodmont, the Company, through a new contract made with West Haven borough, is to furnish many more new street lamps in that section. The new gasholder to be built by the Company will be erected on the Company's land between the Hartford railroad tracks and East street. A part of this land fronting on East street was bought recently, as noted at the time, from the estate of the late Patrick Willis and a part from Mr. and Mrs. Lynch. The pipes of the Company out Whitney avenue extend to near the Whitney Lake dam. The extension to the Country Club house will be the limit of the present extension in that direction. The talked of extension to Centerville may be taken up next year. The Gas Company will issue circulars to their stockholders in a short time, notifying them of the coming issue of the debenture bonds. These bonds for greater convenience in their distribution will be issued in denominations of $100 each and multiples thereof."

The Market for Gas Securities.

Midsummer dullness seems to have settled over the market for gas shares, although the market for other sorts of securities appears to be lively enough.

The quotations for Consolidated gas are virtually those reported at the closing of last week's business.

There is some show of firmness in both common and preferred of Standard, and Central Union bonds are firmly held. Northern Union bonds made a sharp advance within the month, and New Amsterdam 5's also shared in the increase.

Brooklyn Union, like Consolidated, is unchanged, and close observing brokers assert that there is no firmer stock on the market. Baltimore Consolidated sagged off a bit, now that the contest for proxies at the coming election has practically ceased. Well informed Baltimoreans declare that the regular ticket will win easily.

Lacledes are more than holding the recent advance. The feature of the market undoubtedly is the demand for gas bonds, the transactions usually being done in all cases at advancing figures.

Gas Stocks.

Quotations by George W. Close, Broker and Dealer in Gas Stocks.

16 WALL STREET, NEW YORK CITY.

JULY 14.

☞ All communications will receive particular attention.

☞ The following quotations are based on the par value of $100 per share.

N. Y. City Companies.	*Capital.*	*Par.*	*Bid.*	*Asked.*
Consolidated	$73,177,000	100	223½	224
Central Union, Bonds, 5's	3,000,000	1,000	110	112
Equitable Bonds, 6's	1,000,000	1,000	105	
" 1st Con. 5's	2,300,000	1,000	118	120
Metropolitan Bonds	658,000	..	108	112
Mutual	3,500,000	100	350	..
Municipal Bonds	750,000	..	..	..
New Amsterdam Gas Co..				
Bonds, 5's	11,000,000	1,000	112½	113
Northern Union, Bonds, 5's.	1,250,000	1,000	108	110
New York and East River..				
Bonds 1st 5's	3,500,000	1,000	112	113
" 1st Con. 5's	1,500,000	..	109	111
Richmond Co., S. I.	348,650	50	100	..
" Bonds	100,000	1,000	103	.
Standard	5,000,000	100	130	140
Preferred	5,000,000	100	150	160
Bonds, 1st Mortgage, 5's	1,500,000	1,000	114	117
Yonkers	299,650	500	180	.
Out-of-Town Companies.				
Brooklyn Union	15,000,000	100	235	242
" " Bonds (5's)	15 000,000	1,000	119	119½
Bay State	50,000,000	50	1¾	2
" Income Bonds	2,000,000	1,000	.	75
Binghamton Gas Works..	450,000	100	28	30
" 1st Mtg. 5's	500,000	1,000	93	96
Boston United Gas Co.—				
1st Series S. F. Trust	7,000,000	1,000	82	85
2d " " "	3,000,000	1,000	47½	50
Buffalo City Gas Co.	5,500,000	100	11	13
" " Bonds, 5's	5,250,000	1,000	83½	84½
Capital, Sacramento	500,000	50	..	35
Bonds (6's)	150,000	1,000	..	
Central San Francisco	2,000,000	..	106	108
Chicago Gas Co. Guaranteed Gold Bonds	7,650,000	1,000	104	104½
Cincinnati Gas & Elec. Co.	29,500,000	100	103¼	103½
Columbus (O.) Gas Co., 1st Mortgage Bonds	1,500,000	1,000	108	109
Columbus (O.) Gas Lt. & Heating Co	1,682,730	100	88¼	89¼
Preferred	3,026,500	100	106¼	107½
Consumers, Jersey City Bonds	600,000	1,000	102	103
Consumers, Toronto	1,700,000	50	218	225
Consolidated, Baltimore	11,000,000	100	68	70
Mortgage, 6's	3,600,000	..	..	118
Chesapeake, 1st 6's	1,000,000	..	..	..
Equitable, 1st 6's	910,000	..	..	..
Consolidated, 1st 5's	1,490 000	..	.	112
Consolidated Gas Co. of N.J.	1,000,000	100	15	17
" Con. Mtg. 5's	880,000	1,000	85	87
Consolidated G. & E. Co.'s, Little Falls, N.Y.	90,000	100	..	100
Bonds	75,000	..	..	100
Detroit City Gas Co	4,825,500	50	.	89
" Prior Lien 5's	5,603,000	1,000	99½	100
Detroit Gas Co., 5's	852,000	1,000	77	79
" Inc. 5's	16,000	100	94	94½
Equitable Gas & Fuel Co., Chicago, Bonds	2,000,000	1,000	..	101
Essex and Hudson Gas Co.	6,500,000	..	34	38
Fort Wayne	2,000,000	..	.	.
" Bonds	2,000,000	..	58	63
Grand Rapids Gas Lt. Co. 1st Mtg. 5's	1,225,000	1,000	104½	105
Hartford	750,000	25	245	265
Hudson County Gas Co., of New Jersey	10,500,000	..	25	..
" Bonds, 5's	10,500,000	..	101	103
Indianapolis	2,000,000	..	70	80
" Bonds, 6's	2 650,000	..	102½	104½
Jackson Gas Co	250,000	50	73	75
" 1st Mtg. 5's	290,000	1,000	101	102½
Kansas City Gas Light Co., of Missouri	5,000,000	100	..	36
Bonds, 1st 5's	3,822,000	1,000	102	104
Laclede, St. Louis	10,000,000	100	..	95
Preferred	2,500,000	100	..	110
Bonds	10,000,000	1,000	109½	110
Lafayette Gas Co., Ind.	1,000,000	100		60
Bonds	1,000,000	1,000	53	64
Louisville	2,570,000	50	112	120
Madison Gas & Elec. Co.				
" 1st Mtg. 6's	350,000	1,000	107½	108½
" 6 per cent. scrip, due 1910	100,000	25	25	87
Montreal, Canada	2,000,000	100	182	184¼
Newark, N. J., Con. Gas Co	6,000,000	..	56	58
Bonds, 6's	4,800,000	..	105	105¾
New Haven	1,000,000	25	300	325
Nashville Gas Lt. Co.	1,000,000	100	110	..
Oakland, Cal.	2,000,000	..	46	47
" Bonds	750,000	..	..	..
Peoples G. L. & Coke Co., of Chicago	25,000,000	100	101½	101¾
Peoples Gas Lt. & Coke Co., Chicago, 1st Mortgage	20,100,000	1,000	..	..
2d "	2,500,000	1,000	104	
Rochester Gas & Elec. Co..	2,150,000	50	88	..
Preferred	2,150,000	50	118	..
Consolidated 5's	2,000,000	..	87½	90
San Francisco, Cal.	10,000,000	100	43	43½
St. Paul Gas Light Co.	1,500,000	100	45	47
1st Mortgage 6's	650,000	1,000	113	116
Extension, 6's	600,000	1,000	113½	115
General Mortgage, 5's	2,465,000	1,000	92	93
St. Joseph Gas Co.				
" 1st Mtg. 5's	751,000	1,000	95	96½
Syracuse, N. Y.	1,750,000	100	24	27
Bonds	1,612,000	1,000	84	84½
Washington, D. C	2,600,000	20	360	365
First mortgage 6's	600,000	..	..	..
Western, Milwaukee.				
Bonds, 5's	4,000,000	..	109½	110
Wilmington, Del.	600,000	50	232	..

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DIVIDEND NOTICE.

OFFICE OF THE UNITED GAS IMPROVEMENT CO.,
N. W. CORNER BROAD AND ARCH STS.,
PHILADELPHIA, PA., June 11, 1902.

The Directors have this day declared a quarterly dividend of 2 per cent. (one dollar per share), payable July 15th, 1902, to stockholders of record at the close of business, June 30, 1902. Checks will be mailed.

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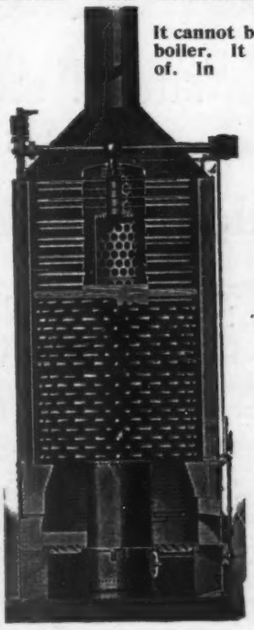

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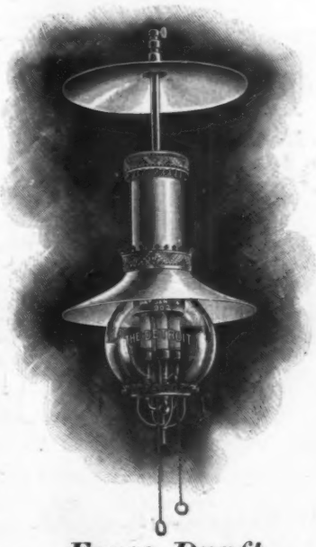

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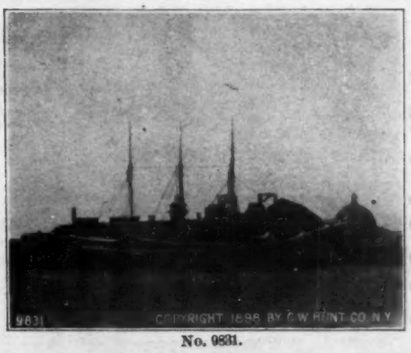

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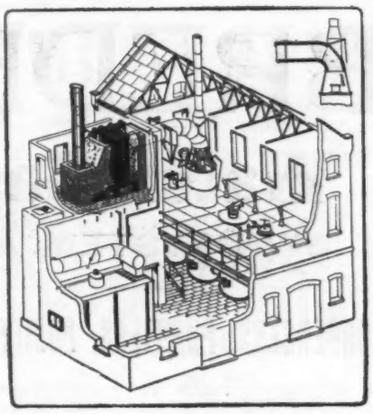

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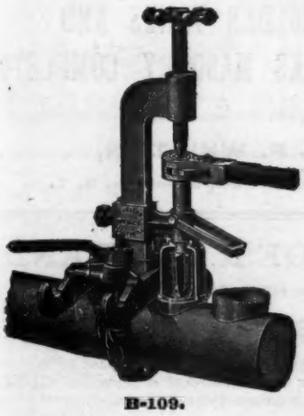
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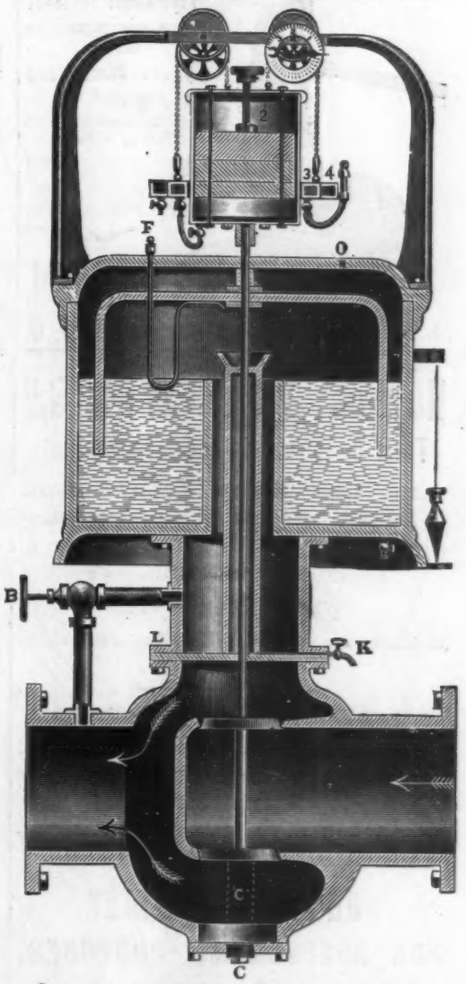

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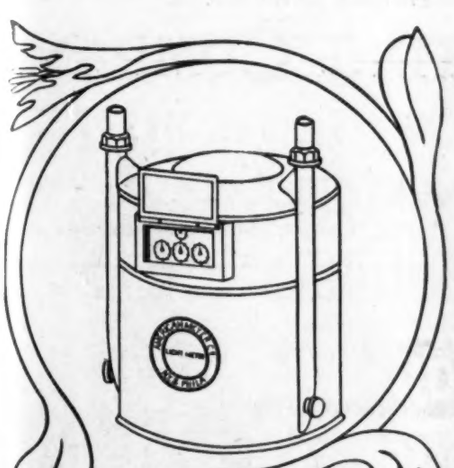
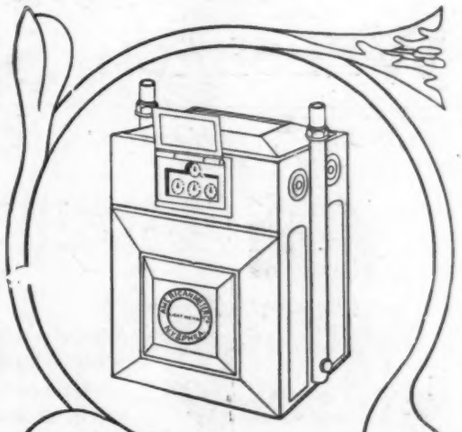
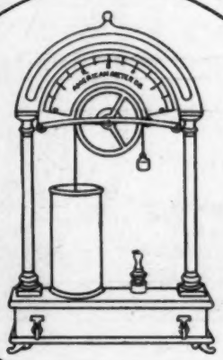


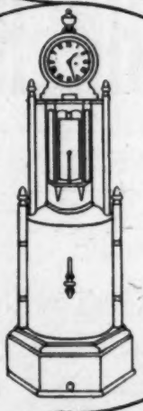


PUBLIC LIGHTING TABLE.

AUGUST, 1902.

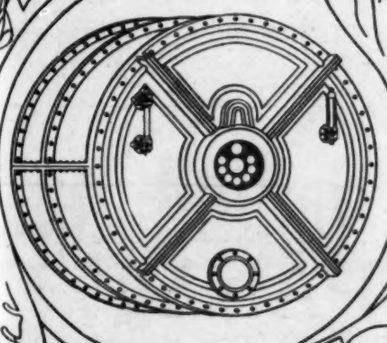
Day of Week.	Table No. 1. Following the Moon. Date.	Light.	Extinguish.	Table No. 2. New York City. All Night Lighting. Light.	Extinguish.
				P.M.	A.M.
Fri.	1	7.50 PM	4.00 AM	7.10	3.30
Sat.	2	7.50	4.00	7.10	3.30
Sun.	3	7.40 NM	4.00	7.10	3.30
Mon.	4	7.40	4.00	7.10	3.30
Tue.	5	7.40	4.00	7.10	3.30
Wed.	6	7.40	4.00	7.10	3.45
Thu.	7	7.40	4.00	7.10	3.45
Fri.	8	8.40	4.00	7.10	3.45
Sat.	9	9 20	4.00	7.10	3.45
Sun.	10	9.50 FQ	4.10	7.10	3.45
Mon.	11	10.30	4.10	7.10	3.45
Tue.	12	11.10	4.10	7.10	3.45
Wed.	13	12.00	4.10	6.55	4.00
Thu.	14	12.50 AM	4.10	6.55	4.00
Fri.	15	1.40	4.10	6.55	4.00
Sat.	16	2.40	4.10	6.55	4.00
Sun.	17	No L.	No L.	6.55	4.00
Mon.	18	No L. FM	No L.	6.55	4 00
Tue.	19	No L.	No L.	6.55	4.00
Wed.	20	7.20 PM	8.20 PM	6.45	4.10
Thu.	21	7.20	8.50	6.45	4.10
Fri.	22	7.20	9.30	6.45	4.10
Sat.	23	7.20	10.00	6.45	4.10
Sun.	24	7.10	10.40	6.45	4.10
Mon.	25	7.10 LQ	11.30	6.45	4.10
Tue.	26	7.10	12.20 AM	6.45	4.10
Wed.	27	7.10	1.20	6.30	4.20
Thu.	28	7.10	2.20	6.30	4.20
Fri.	29	7.10	4.20	6.30	4.20
Sat.	30	7.10	4.20	6.30	4.20
Sun.	31	7.00	4.30	6.30	4.20

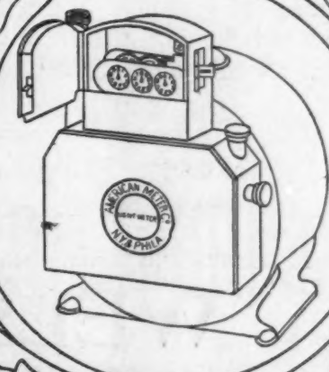




TOTAL HOURS LIGHTING DURING 1902.

By Table No. 1.	Hrs. Min.	By Table No. 2.	Hrs. Min.
January	238.30	January	423.20
February	196.20	February	355.25
March	196.20	March	355.35
April	166.40	April	298.50
May	151.40	May	264.50
June	131.10	June	234.25
July	142.40	July	243.45
August	162.00	August	280.25
September	179.00	September	321.15
October	216.30	October	374.30
November	224.10	November	401.40
December	250.00	December	433.45
Total, yr.	2255.00	Total, yr.	3987.45





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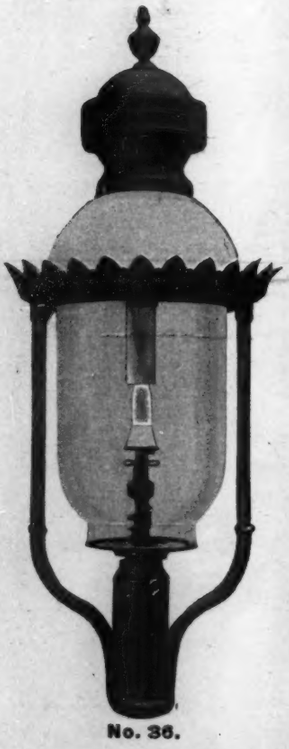

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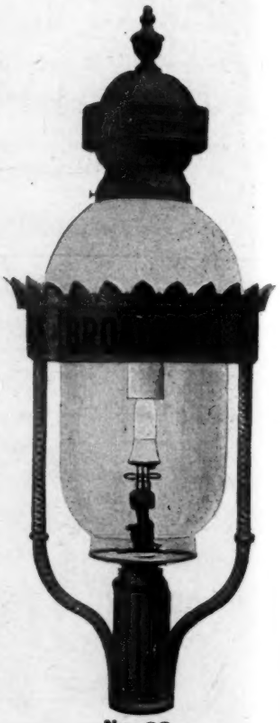

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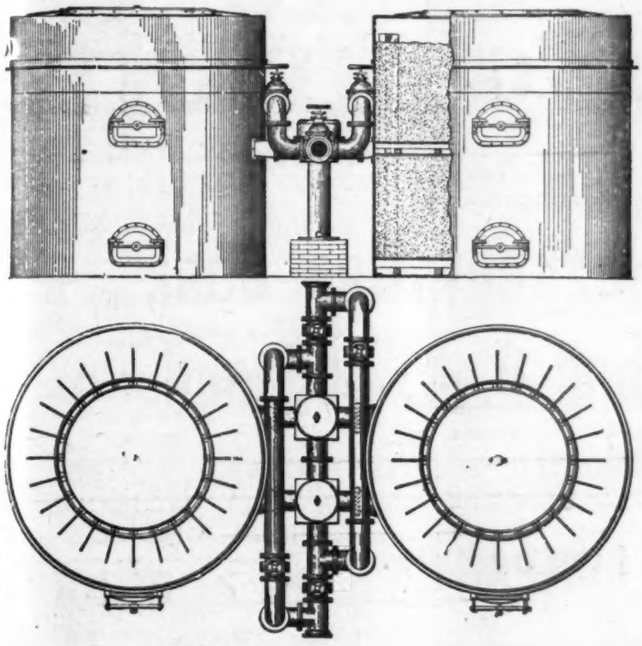

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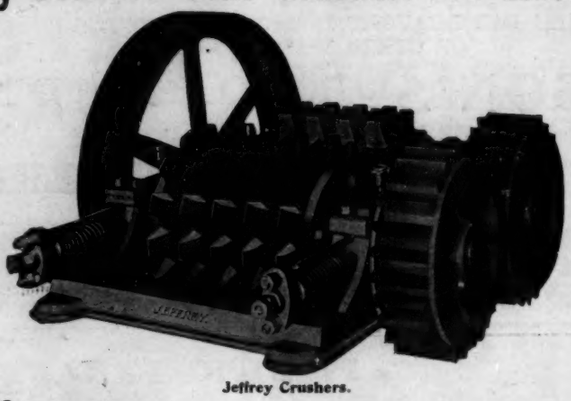

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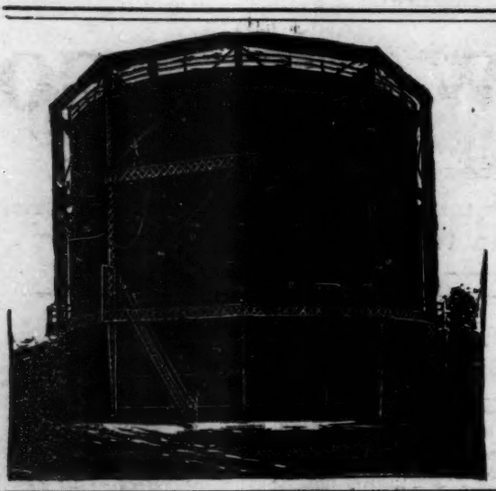

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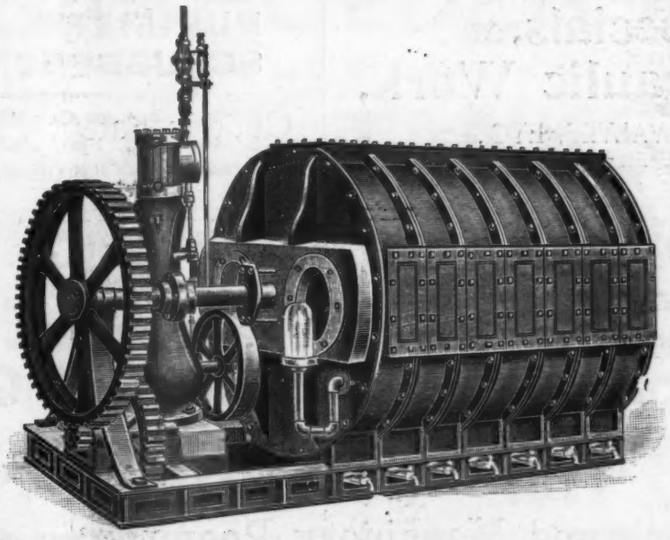

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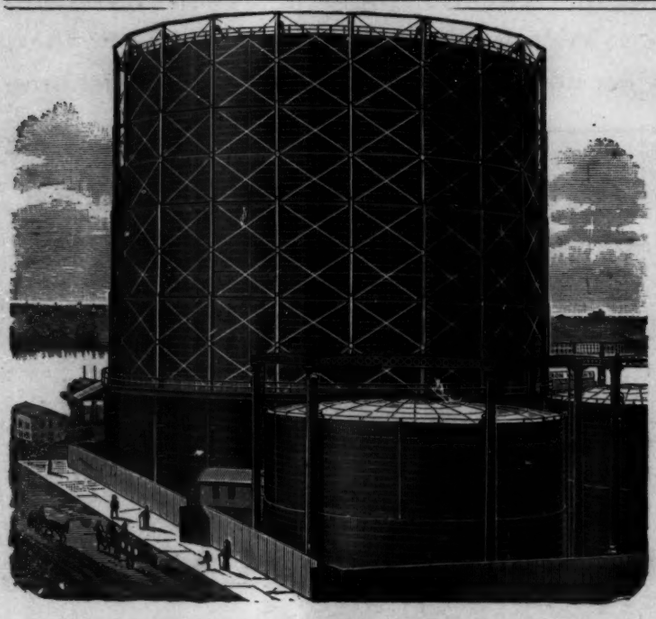

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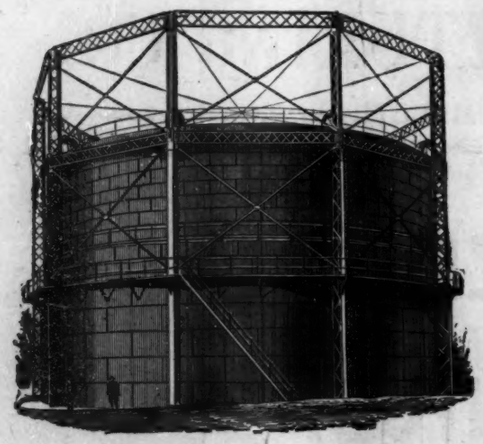

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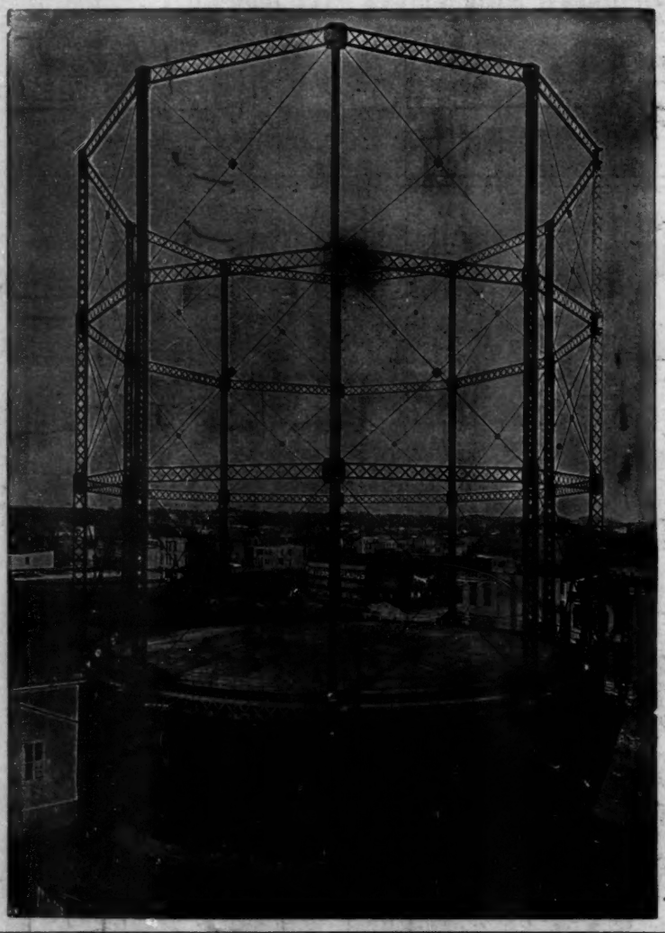

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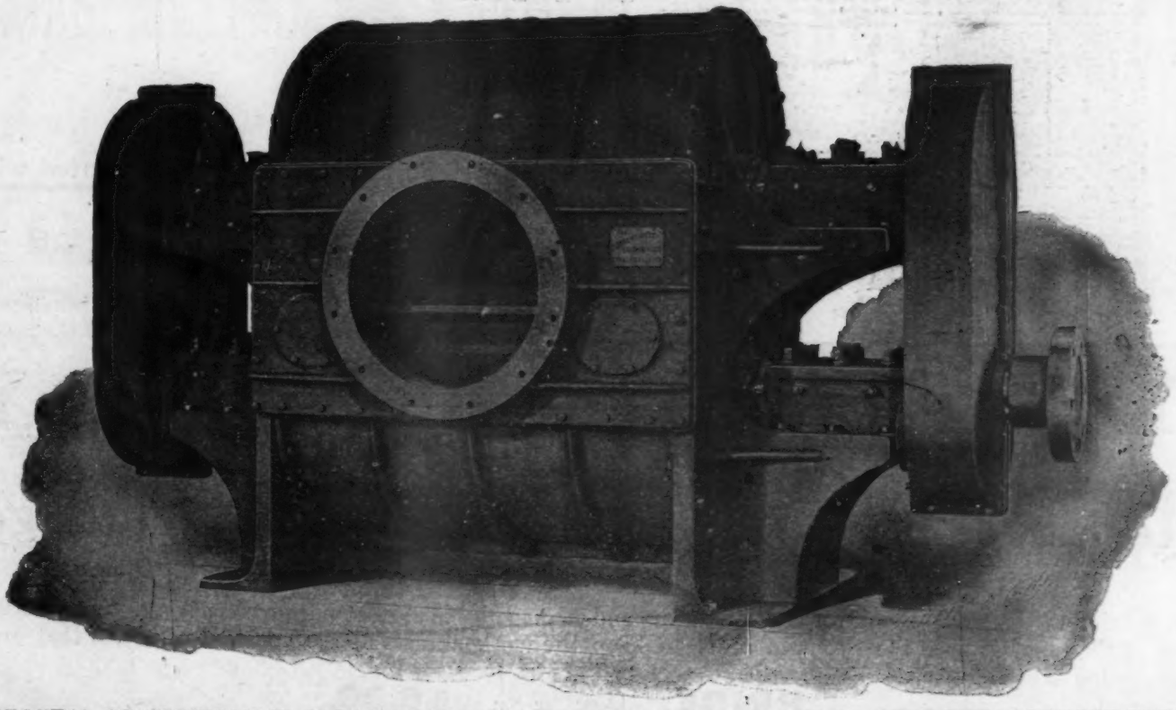

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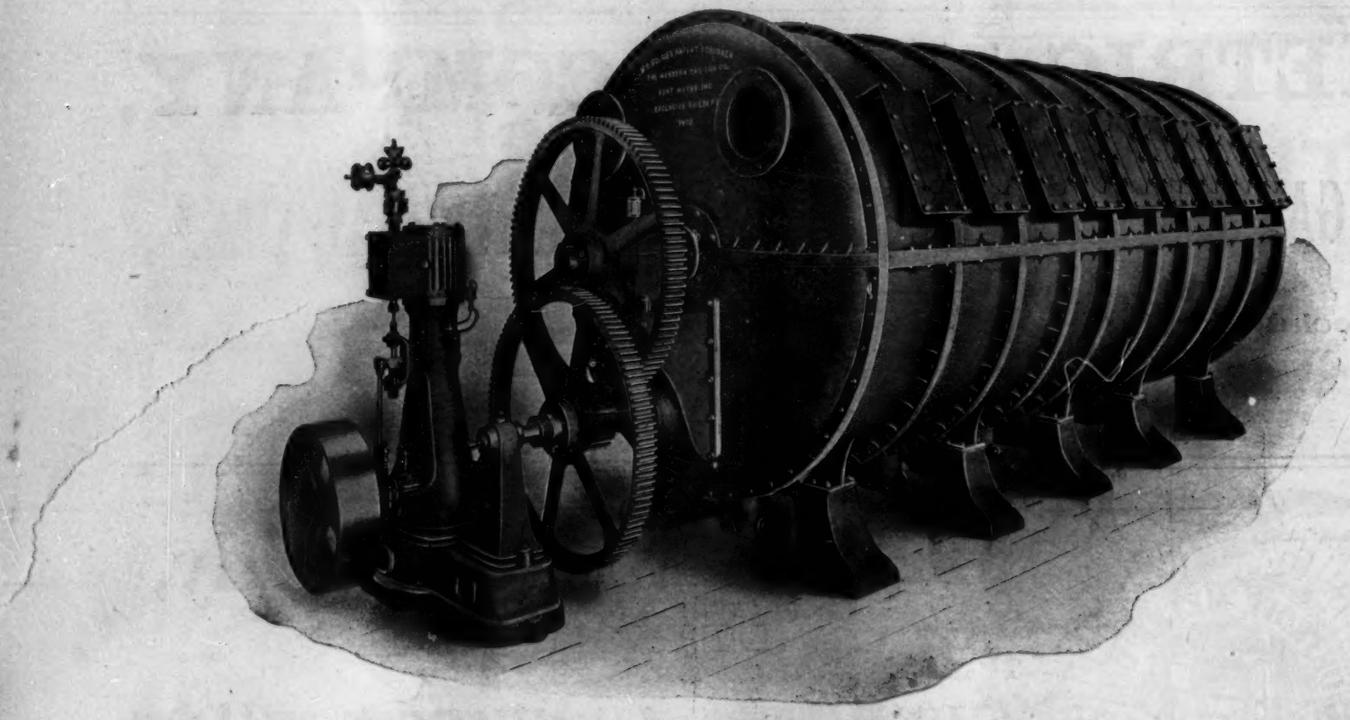

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